

# The Impact Assessment of the EU Pre-Accession Funds on Agriculture and Food Companies: The Croatian Case

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**The Impact Assessment of the EU Pre-Accession Funds  
on Agriculture and Food Companies: The Croatian Case**

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## The Impact Assessment of the EU Pre-Accession Funds on Agriculture and Food Companies: The Croatian Case

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### **Abstract:**

The EU pre-accession funds available to EU candidate countries play an important role in their adjustment for membership. Croatia, as a candidate country, used the Special Pre-Accession Program for Agriculture and Rural Development and the Instrument for Pre-Accession Assistance – Rural Development, one of the goals of which was to strengthen the competitiveness of businesses in the agriculture and food production sectors. The usage period covered two EU programming periods, as well as a recession period in Croatia that lasted from 2009 to 2014. An insight into the available literature reveals a lack of rigorous research and evaluation of the results of using these funds in Croatia as well as in other beneficiary countries. This paper evaluates the effect of pre-accession EU grants on beneficiaries in the agri-food sector using a quasi-experimental approach on the case of Croatia. The grants were shown to have a positive effect on firm survival, as well as positive effects on obtaining bank loans and increasing turnover, value added, employment, and total factor productivity. Heterogeneous treatment effects show that the grants resulted in the greatest additionality for micro-sized firms located in Central Croatia. Cost-benefit analysis estimates an increase in the value added, which outweighs scheme-induced costs by 120 percent in the short run and 90 percent in the mid run.

**Keywords:** public grants, policy evaluation, SAPARD, IPARD

**JEL classification:** B54, J16, H81, L26, L38, H43

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## Procjena učinka pretpristupnih fondova EU-a na poljoprivredna i prehrambena poduzeća: slučaj Hrvatske

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### **Sažetak:**

Pretpristupni fondovi EU-a koji su na raspolaganju zemljama kandidatkinjama za EU igraju važnu ulogu u prilagodbi za EU članstvo. Hrvatska je kao država kandidatkinja koristila Posebni pretpristupni program za poljoprivredu i ruralni razvoj i Instrument pretpristupne pomoći – ruralni razvoj, čiji je jedan od ciljeva bio jačanje konkurentnosti poduzeća u sektoru poljoprivrede i proizvodnje hrane. Razdoblje korištenja obuhvaćalo je dva programska razdoblja EU-a, kao i razdoblje recesije u Hrvatskoj od 2009. do 2014. Uvid u dostupnu literaturu otkriva nedostatak rigoroznog istraživanja i procjene rezultata uporabe ovih sredstava u Hrvatskoj i ostalim zemljama korisnicama. Ovaj rad ocjenjuje učinak pretpristupnih bespovratnih potpora EU-a na korisnike u poljoprivredno-prehrambenom sektoru koristeći kvazi-eksperimentalni pristup na slučaju Hrvatske. Rezultati pokazuju da potpore imaju pozitivan učinak na opstanak poduzeća, kao i pozitivne učinke na dobivanje bankovnih zajmova, povećanje prometa, dodanu vrijednost, zaposlenost i ukupnu faktorsku produktivnost. Heterogeni učinci dobivanja potpora pokazuju da su bespovratna sredstva imala najveće efekte za poduzeća mikro veličine koja se nalaze u središnjoj Hrvatskoj. Analiza troškova i koristi procjenjuje povećanje dodane vrijednosti koje nadilazi troškove izazvane shemom za 120 posto u kratkom roku i 90 posto u srednjem roku.

**Ključne riječi:** javne potpore, evaluacija politika, SAPARD, IPARD

**JEL klasifikacija:** B54, J16, H81, L26, L38, H43





# 1 Introduction

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The European Union (EU) countries have a long-term practice of monitoring and evaluating the performance of rural development policies and programs. For this purpose, a system of common monitoring objectives, procedures, and indicators was developed in the form of the common monitoring and evaluation framework (CMEF). During the accession phase, EU candidate countries are entitled to pre-accession EU funds, which, inter alia, serve the purpose of adopting the monitoring and evaluation practice of the implementation of publicly funded programs.

In Croatia, the use of pre-accession funds started in 2006 with the Special Pre-Accession Programme for Agriculture and Rural Development (SAPARD, 2005–2006), and ended in 2014 with the last year of the Instrument for Pre-Accession Assistance – Rural Development (IPARD, 2007–2014). National institutions have sought to program and implement these instruments in accordance with the EU practice. However, the lack of experience, capacities, and expertise of the institutions, accompanied with additional aggravating circumstances, has led to the implementation difficulties that have resulted in poor absorption (Ministry of Agriculture, 2011; KPMG Croatia, 2017).

One of the shortcomings in the implementation of pre-accession funds in Croatia is the lack of impact assessment, especially with regard to the business entities that received most of the allocated funds. Dvoulety and Blažkova (2019) also acknowledge this fact, so in their analysis of agribusiness in the Czech Republic they call for similar impact evaluations of public policies. Our paper addresses this research gap by examining whether EU pre-accession grants increase the firm's survival and performance.

Despite the similarities with some other Central and Eastern European (CEE) countries, the Croatian case is interesting because of certain peculiarities. Firstly, Croatia is the only candidate country that has used both SAPARD and IPARD programs. Secondly, during the program implementation period, Croatia was hit by a long-term economic crisis (2009–2015) caused by the 2007 global financial crisis. Unique to Croatia is that, unlike other CEE economies, it took the country six years to bounce back to the positive growth paths that have been recorded since early 2015. Public grants that are the focus of this research were introduced just at the onset of this crisis and were running throughout the recession period. Thus, firms in our dataset had to operate in the hostile economic climate for several years before and/or after the grant receipt. Finally, during the 1990s, due to the Homeland War in Croatia (1991–1995), the agricultural policy was on the margins of government activities. The first significant step towards a more serious approach to agricultural development and planning came in 1995 with the first development strategy for agriculture (Ministry of Agriculture, 2005). An important moment for the national agricultural policy was the adoption of the Act on Agriculture (Official Gazette of the Republic of Croatia, 2001), which regulates the agricultural policy objectives and measures. Subsequent amendments to the act also included provisions regarding pre-accession funds.

Agriculture in Croatia still represents an important economic activity, accounting for 3–4 percent (2007–2016) of the gross value added (GVA). The proportion declined from its peak in 2008 (4 percent) with the onset of the financial crisis, to 3.1 percent in 2016. The Croatian economy moved into crisis in 2009, but it was not reflected equally in all sectors of the economy. Juračak and Vukalović (2013) find that the impact of the crisis on agricultural enterprises in Croatia was greater than the impact on the overall economy. The share of the food industry is more or less constant in the same period, amounting to about 3.2 percent of total GVA. During the same period, the employment rate in legal entities registered for agriculture, food production, and beverage production was between 4.5 percent and 5 percent of total employment.

This study seeks to measure and elaborate the impact of SAPARD and IPARD grants on firm survival, output growth, employment growth, capital growth, productivity growth, and indebtedness. We postulate that business development grants may act in both a direct and indirect way. For example, in McKenzie (2017), administered grants were substantial enough to have a direct impact by enabling capital purchase and immediate hiring. On the other hand, other studies have shown that administered grants can be too small to produce any direct effect, but may nonetheless impact firm survival and performance indirectly via certification effect (Srhoj, Škrinjarić, and Radas, 2019) or via behavioral additionality (Srhoj et al., 2019). In our case, the observed grants are sufficiently large (on average 0.4 million EUR, i.e., 3.1 million HRK) to directly impact firms' output in the short and mid term.

This research is conducted on firm-level data, and is based on a quantitative research approach. The present work is based on our previous study (Kukoč, Škrinjarić, and Juračak, 2019), which found that SAPARD and IPARD grants did not have a significant impact on firm survival and firm performance during the recession. It is worth noting, however, that these conclusions were based on descriptive analysis, lacking rigorous empirical research. In the present study, we implement policy evaluation by utilizing counterfactual impact analysis, i.e., a combination of difference-in-difference (DID) approach and propensity score matching (PSM), to investigate policy impact on firm survival and performance in Croatian agricultural, food manufacturing, and beverage manufacturing industries in the short and mid run after receiving program financial support. The results of the current analysis show a positive premium of obtaining the aforementioned grants on firm survival in the short run, and on output and performance additionality in the mid run.

The purpose of this paper is also to contribute to the studies and methods of public funds impact evaluation in four main respects. Firstly, we analyze a type of grant that has been largely neglected by the literature, i.e., a pre-accession grant targeted exclusively at the agri-food sector. Next, we employ a rich dataset with a universe of firms, which is used to select a counterfactual that is as close as possible to the treated firms. Thirdly, our dataset allows for grant impact evaluation both in the short and the mid run after receiving a subsidy. Finally, our paper contributes to the literature with an analysis of grants impact on agri-food firms in a long recession period.

The remainder of the paper is organized as follows: Section 2 presents the literature review and Section 3 describes the institutional setting. Section 4 presents data and methodology followed by the results in Section 5. The last section, Section 6, provides the discussion and conclusions.

## 2 Literature Review

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In most EU member states, both older ones and those that joined the EU in 2004, assessing the impact of public grants on beneficiaries' performance is common practice. Depending on the methodology and indicators used, some authors find that public grants have a negative impact on the beneficiaries, while in some studies this effect is found to be positive. A statistically reliable impact estimation of public grant support on business performance and development can be given by utilizing various methods. Among the most popular, the application of counterfactual analysis has been widely used to assess the impact of various public policies on beneficiaries in the EU, in the pre-accession period or as part of the Rural Development Programs.

Utilizing counterfactual analysis, Mezera and Špička (2013) investigated the impact of investment aid on the processing industry in the Czech Republic and found a positive impact of the aid on beneficiaries' financial stability, productivity, and added value, but also a smaller negative impact on their profitability. Rättinger, Medonos and Hruška (2013) analyze the effect of the Czech Rural Development Program 2007–2013 on four business performance indicators by comparing grant beneficiaries and non-beneficiaries. They identify a positive effect on gross value added, productivity, and indebtedness, and a negative effect on the firm's profit. Pagliarino et al. (2014) investigate the impact of the Rural Development Program in the Italian region of Piedmont for the 2005–2012 period on the economic performance of agri-food companies. They determine a positive impact on the average number of employees, value added per employee, and value of assets per employee. However, the profitability indicators (ROE, ROI, and ROS) increased equally among the treated and the control group, which was attributed to the impact of the economic crisis that prevailed and, in their view, affected both of those groups in a similar way.

Dantler et al. (2010) analyze the impact of grants from the investment measures of the Rural Development Program in the dairy sector in Austria. Their analysis covered agricultural holdings and they found a positive impact of the received grant on annual income and gross value added per farm, and a smaller positive effect on employment. Exploring the impact of both pillars of the Common Agricultural Policy (CAP) on employment in three German provinces (Brandenburg, Saxony, and Saxony-Anhalt), Petrick and Zier (2010) determine that investment measures and measures targeting less favored areas bear no significant effect on employment. More recently, Dvouletý and Blažková (2019) also use counterfactual analysis to analyze the effect of EU public policy on the Czech food processing industry. Their results

suggest a positive effect on the performance of supported firms measured by the price - cost margin, value added per labor cost, growth of sales, and growth of tangible assets.

Nevertheless, impact evaluation methods other than counterfactual have also been used, although to a lesser extent. Špička, Naglova and Gurtler (2017) used a fixed-effect panel data model to investigate effects of EU aid on the meat industry in the Czech Republic. They found a significant impact on increasing productivity in large enterprises, concluding, *inter alia*, that national aid models have a significantly greater impact on business performance than EU aid. In Latvia, using grouping and comparative analysis, Veveris (2014) investigated the impact of investment aid on farms with respect to three indicators: employment, total income, and gross value added. The results show a visible positive effect on all three indicators, and although there was a decrease in the number of employees among the beneficiaries, this decrease is much smaller than with the non-beneficiaries. This finding in terms of employment is attributed to the impact of the global financial crisis of 2007. Rizov, Pokrivcak and Ciaian (2013) explore the impact of CAP support on farm productivity within the EU in the 1990–2008 period using structural semi-parametric estimation. Their results indicate that the grant impact on overall factor productivity was negative in the period before the CAP reform in 2003, when the transition from coupled payments to decoupled payments occurred. Following the reform, the impact of the grants became positive in 10 of the 15 EU countries analyzed.

Focusing now on the scarce studies assessing the impact of SAPARD programs, using before-and-after design, Bryla (2005) identified positive effects on the number of employees, labor productivity, and production value of entities in the Polish food-processing industry. Michalek (2012) assessed the impact of SAPARD programs in Slovakia using conditional difference-in-difference method, and found negative grant impact. In the control group, faster profit growth, higher total profit, and higher profit per hectare of utilized agricultural area were observed in comparison to the beneficiaries group, while the beneficiaries recorded higher levels of employment only. Similarly, Hapenciuca et al. (2014), who analyze the effect of SAPARD on local tourism in Romania, find no significant effect of using the program on the local economy.

Specific to Croatia, ex-post evaluations of SAPARD and IPARD programs have been carried out at the level of the program and at the level of individual program measures (Ministry of Agriculture, 2011; KPMG Croatia, 2017). However, these evaluations do not provide information on the impact of the grants on business survival and performance. Instead, these reports offer evaluations based on simple comparison of achieved and targeted values of selected indicators. The same is true for unofficial evaluations, which also assess the success of implementation rather than the impact of the program (Mück and Bakker, 2013).

Actual, rigorous evaluation of SAPARD and IPARD public grants on individual firm survival and performance in Croatia is practically non-existent. One notable exception is Božanić

(2018), who compared performance indicators and financial stability of fish processing companies before and after using IPARD support. Using a naive approach (a simple “before and after” a public grant comparison), she found no significant differences between the values before and after using the support for most financial performance indicators, except for financial stability indicators.

A review of the available literature suggests that the impact of pre-accession funds for agriculture and rural development on the financial performance of Croatian business entities has not been sufficiently investigated. Hence, information on the net impact of pre-accession funds on businesses is not available. This paper seeks to reduce the lack of counterfactual analysis of the impact of pre-accession programs on agricultural and food companies in Croatia, and to evaluate the nature and intensity of the impact of the programs..

### 3 Institutional Setting

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When Croatia obtained EU candidate status in 2004, it was facing a number of challenges with respect to development of agriculture and rural areas. The most important ones worth highlighting include: (1) low competitiveness of agriculture and food industry, (2) underdeveloped rural infrastructure, (3) unsatisfactory access to public goods, and (4) existence of war damaged and depressed rural areas (European Commission, 2005). With the EU candidate status obtained, Croatia got the opportunity to use pre-accession funds for agriculture and rural development as an assistance in the adjustment process, first SAPARD, followed by IPARD (more details in Appendix, Table A1). Objectives of the pre-accession programs were to support the implementation of the *acquis communautaire* regarding the EU Common Agricultural Policy, as well as to help restructuring and a smooth integration of the national agricultural sector to that of the EU.

Two investment support measures were available to Croatian farmers and food manufacturers within SAPARD (Ministry of Agriculture, 2005): (1) M1 “Investment in agricultural holdings”, and (2) M2 “Improvement in processing and marketing of agricultural and fishery products”. A total allocation of 33.3 million EUR was reserved in the EU and national budgets for both measures. Final beneficiaries of M1 were farms registered in the national Farm Register and registered for VAT, while final beneficiaries of M2 were trades, crafts, and legal entities registered for VAT and registered for business activities eligible for M2, either in private or state ownership (up to 25 percent of the latter). Eligible sectors for support under M1 were: dairy (cow’s milk), meat (beef, pork, and poultry), egg production, fruit and vegetables, cereals, and oil seed crops. M2 co-financed investments in milk, meat, fish, fruit, and vegetables processing sector. The maximum level of public support in both measures was up to 50 percent of the eligible expenditure, while the maximum amount allowed per beneficiary was 0.3 million EUR (2.5 million HRK) in M1 and 1.4 million EUR (10.0

million HRK) in M2. During the SAPARD implementation, a total of 37 projects were co-financed (19 within M1 and 18 within M2), for which a total of 16.1 million EUR (117.2 million HRK), i.e., 48.2 percent of the allocated SAPARD assistance, was paid.

Parallel to the implementation of the pre-accession program SAPARD, national investment support models for agriculture and rural development were available in Croatia. The application procedure, required documentation, and control over the use of national support programs were far less demanding than in the pre-accession funds, which may be one of the reasons for the under-utilization of the latter. In addition, the use of the national Capital Investment Support Model (CISM) was strongly encouraged in some sectors, which then underperformed in the use of SAPARD (e.g., cattle and pig sectors). In order to divert farms to make greater use of EU funds, just at the time of the economic crisis in late 2009, the CISM was abandoned. However, in the 2008–2015 period, a total amount of 24.12 million EUR (1.79 billion HRK) was paid to 12,268 beneficiaries of the CISM (Ministry of Agriculture of the Republic of Croatia, 2012, 2013 and 2016).

By the end of 2009, the IPARD program became operative, replacing SAPARD. There were six measures available in IPARD (Ministry of Agriculture 2010), two of which are covered by this research because they are the same as the SAPARD M1 and M2 measures. These IPARD measures are: (1) M101 “Investments in agricultural holdings to restructure and to upgrade to Community standards”, and (2) M103 “Investments in the processing and marketing of agriculture and fishery products to restructure those activities and to upgrade them to Community standards”. The total allocation for the two measures from the national and EU budget was 152.2 million EUR (1.1 billion HRK, 62.12 percent of the total IPARD budget).

Beneficiaries of M101 were farms listed in the Farm Register, registered for VAT, private or with up to 25 percent of state or local government ownership. Eligible investments covered the sectors of dairy, beef, pork, poultry, egg production, fruit, vegetables (excluding mushrooms), cereals, and oil seed crops. The proportion of public grant support was up to 50 percent of total eligible investment, with exceptions that were eligible for 55 percent, 60 percent, 65 percent, or even 75 percent of public co-financing. The maximum grant per beneficiary was set at 0.9 million EUR (6.6 million HRK), except in the egg production sector, where it was 2.0 million EUR (14.6 million HRK).

Within M103, beneficiaries were trades and crafts, companies, and cooperatives registered for eligible activities and registered for VAT, with less than 25 percent of state or local/regional government ownership. Acceptable enterprises were those with less than 750 employees and with annual turnover not exceeding 200 million EUR (1.5 billion HRK). This measure supported investments in milk, meat, fish, fruit and vegetable processing, winemaking, and olive oil production. The level of public grant support was up to 50 percent of the eligible investment, while the maximum aid per project was 3.0 million EUR (21.9 million HRK),

with the exception of olive oil production that had a maximum of 0.5 million EUR (3.7 million HRK).

During the implementation of IPARD, a total of 520 project applications were received for M101, of which 290 were accepted and co-financed. For M103, 136 project applications were received and funds for 69 beneficiaries were disbursed. Beneficiaries in both measures were all classified as business entities. A total of 84.3 million EUR (627.9 million HRK) of public funds was disbursed for the two measures, which, compared to the initial allocation, makes a 55.34 percent utilization rate. This utilization rate is in line with the overall utilization of IPARD (all six measures) in Croatia (55.6 percent).

In the IPARD period, there was no overlap with national support models, but at the end of the period, the overall utilization (55.6 percent) was not much higher than the utilization of SAPARD (48.2 percent). One of the reasons for this may be the scarce availability of credit that the majority of potential users needed in order to close the financial structure (50 percent of the investment). At the time of IPARD implementation, advance payments for approved projects were not eligible, and commercial banks were reluctant to approve loans at the time of the worst financial crisis. However, the process gained momentum after the Croatian Bank for Reconstruction and Development became involved in the lending system (Croatian Bank for Reconstruction and Development, 2016). Reasons for poor utilization can also be found in the extremely slow application handling process, which sometimes took more than a year. The interest in IPARD measures increased significantly after 2012, and the last call for proposals was in April 2014. It marked the end of IPARD implementation and a shift to the implementation of the first Croatian Rural Development Program (RDP). With the announcement of RDP, many beneficiaries withdrew already contracted applications, expecting more benefits from the RDP measures. In accordance with the “n + 3 rule”, the implementation of IPARD projects continued until December 31, 2016, when all contracted and realized projects had to be paid.

In this study, the subsequent analysis focuses on the recipients of SAPARD and IPARD grants in the 2007–2016 period that are subject to corporate income tax (profit tax). The reason for this approach is that only profit tax payers are obliged to submit their financial reports in Croatia, while financial results of other types of business are not available for analysis. In total, 157 SAPARD and IPARD grants were awarded over the 2007–2016 period for the selected group of companies. The total amount of received support was 64.9 million EUR (481.2 million HRK), with the average amount of 0.4 million EUR (3.1 million HRK) per project (Appendix, Table A2).

## 4 Data and Methodology

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### 4.1 Data

Data for this analysis come from two datasets: (1) financial and structural data on the population of Croatian enterprises for the 2003–2017 period, obtained from the Croatian Financial Agency (FINA), and (2) data on SAPARD and IPARD grants in the 2007–2016 period, obtained from the Ministry of Agriculture. The former dataset includes balance sheet and profit and loss statement data covering more than 300 variables for the universe of Croatian trade companies, as well as firm characteristics such as region, size, industry sector, firm ID, and year of the report. On the other hand, the Ministry dataset includes the name of the grant recipient, the amount of grant given, and the year the grant was received.

Upon merging the FINA and Ministry datasets, data are available on 201,345 firms, 131 of which obtained the analyzed grants. We removed all foreign-owned and state-owned firms, as these were not eligible as recipients for the analyzed grants. For the same reasons, we removed all firms that reported positive unpaid debts towards the state in the year prior to treatment. We only kept the firms operating in NACE Rev. 2 two-digit sectors: 01 (Agriculture, forestry and fishing), 10 (Manufacture of food products), and 11 (Manufacture of beverages). Lastly, we removed all firms that have received these grants more than once, as we would not be able to disentangle the effect of each grant for that particular firm. Finally, we ended up with 114 grant-awarded firms (treated firms) and 3,153 potential control firms. The total amount of received support in our final sample was 47.6 million EUR (354.2 million HRK), with the average amount of 0.4 million EUR (3.1 million HRK) per project (Table A2). Table A3 in the Appendix further presents grant distribution according to firm size, sector, and region.

### 4.2 Method Applied

The methodological approach identifies the causal effect by comparing outcomes between a treatment group and a control group (Rosenbaum and Rubin, 1983). Treatment is usually modelled as a binary variable  $D$ , taking the value 1 for the treated firms and 0 for the control (non-treated, counterfactual) firms. The greatest challenge is to find a control firm that is as similar as possible for each treated firm as firms may systematically differ in both observable and unobservable characteristics (Heckman, Ichimura, and Todd, 1998). To mitigate this problem, Rubin (1977) introduced the conditional independence assumption (CIA), stating that potential outcomes are independent of treatment assignment (i.e., that exposure to treatment can be considered random), given a set of observable covariates  $X$ , which are not affected by the treatment, i.e.,  $Y(D=0), Y(D=1) \perp D | X$ , where  $Y(D)$  denotes the potential outcome.



Empirically, this allows each treated firm to be matched with one (or several) control firms that are as similar as possible in their pre-treatment characteristics. We estimate this similarity of treated and control firm using a propensity score as our matching metric. This propensity score is defined as the conditional probability of receiving treatment given pre-treatment characteristics and is estimated using a standard probit model. We restrict the propensity scores to the common support area, thus considering only firms in the intersection of the range of the propensity scores for treated and control firms. Finally, the control firm for each treated firm is selected using a combination of exact matching and nearest neighbor matching (for the baseline scenario) without replacement as our matching method. Once the control firms are matched to the treated firms, we compare the period before the treated firms received the subsidy (one year prior to treatment) and period up to five years after obtaining the subsidy. By concentrating on a five-year window following the treatment (much like in Srhoj, Škrinjarić, and Radas, 2019 or Srhoj et al., 2019), our analysis identifies both the short- and the mid-term effect of the analyzed programs. Average treatment effect on the treated (ATET) is then calculated as an average difference in performance of the treated firms between the periods after and before the implementation of the program, and at the same time, also as a difference between the treated and control groups. Hence, we apply propensity score matching in combination with a difference-in-difference approach.

To check the robustness of our baseline findings, we conduct three robustness checks: (1) a placebo test, (2) sensitivity analysis using different matching metrics and methods, and (3) Rosenbaum bounds test. For the placebo test, we discard the treated group, make the control group from our main specification a *placebo-treated* group, and repeat our main specification matching procedure. If the observed ATET effects are due to the grants, the placebo treatment should have no effect on firm performance. This procedure is repeated 10,000 times to empirically obtain the distribution of the ATET estimates, to avoid relying on the calculated standard errors (Abadie and Imbens, 2008) or on the normality distribution of the ATET estimates. Secondly, we conduct a sensitivity analysis regarding the matching approach. We estimate nearest neighbor matching with two, three, and four control firms per treated firm; nearest neighbor matching with two, three, and four control firms per treated firm but with a caliper set at 10 percent of the standard deviation of the estimated propensity score; and radius matching with the same caliper. Finally, as matching methods can suffer from hidden bias (caused by unobservables that simultaneously affect assignment to treatment and the outcome variable), we conduct a Rosenbaum bounds test (Rosenbaum, 2002), which is increasingly used for sensitivity analyses in the literature. The Rosenbaum bounds method addresses the endogeneity problem by quantifying the extent to which the usual assumption of matching methods is violated – it estimates to what extent the results are robust to the hidden bias. The method relies on the sensitivity parameter  $\Gamma$  that estimates the magnitude of the hidden bias that would render the test statistics of the study inference insignificant. When  $\Gamma = 1$ , the treatment effect is bias free (i.e., the assignment to treatment is random), while higher values of  $\Gamma$  indicate departure from randomness by showing the extent of impact that confounding

variables have on the selection into treatment. The Rosenbaum bounds method is valid regardless of the strength of the confounding variable on the outcome (DiPrete and Gangl, 2004)<sup>1</sup>.

### 4.3 Variables Used in the Analysis

All relevant variables for the public call schemes as well as covariates considered as important in the literature are used to calculate our matching metric – the propensity score. As covariates (Table 1), we select relevant firm characteristics and performance indicators that affect not only the selection into treatment, but the outcome as well. While some covariates are obvious, such as firm age, region, and size (measured in number of employees and real turnover), other covariates are proxies for firm characteristics. For example, firms that pay higher average wages have on average larger capital and cash reserves, and thus are more likely to be financially stronger. Such firms may either not be interested in applying for the grants, or if they do apply, they may “make more out of it” than weaker firms do. We also include debt ratio and liabilities towards banks to capture financial constraints of firms, because firms with higher financial constraints are found to be more vulnerable (Musso and Schiavo, 2008; Stucki, 2013). This vulnerability can induce firms to seek public aid, and is also likely to affect how well the firm uses the grant. The set of covariates also contains measures of productivity, such as real value added per employee and total factor productivity (TFP). Firms that are exporters tend to be more productive (Costa, Pappalardo, and Vicarelli, 2017) and to have specific entrepreneurial skills and human capital (Brambilla, Lederman, and Porto, 2012) that can affect both receiving a grant and the potential outcomes. Therefore, we include a full set of firms’ trade orientation dummies.

Table 1 <b>Covariates Used for Calculation of Propensity Score</b>	
Variable	Description
<i>Treatment variable</i>	
grant	1 if the firm received any grant scheme funding, 0 otherwise
<i>Firm characteristics</i>	
Age	Age of the firm
Age squared	Squared age of the firm
Ownership	Ownership of the firm: 1 – State, 2 – Private, 3 – Mixed
NACE 2-digit sector	1 – Crop and animal production, hunting and related service activities, 10 – Manufacture of food products, 11 – Manufacture of beverages
Region of the firm	Region of the firm <sup>a</sup> classified as: 1 – Zagreb region, 2 – Western Croatia, 3 – Eastern Croatia, 4 – Central Croatia, 5 – Southern Croatia
Firm size	Size of the firm: 1 – Micro, 2 – Small, 3 – Medium, 4 – Large
Trade orientation	Trade orientation of the firm: 1 – Exporter only, 2 – Importer only, 3 – Exporter and importer, 4 – Domestic market only
<i>Firm performance characteristics<sup>b</sup></i>	
Labor	ln (1 + number of employees)
Average wage	ln (1 + real average wage)

<sup>1</sup> For further details on Rosenbaum’s bounds approach, please see Appendix B.

Capital	ln (1 + real tangible fixed assets)
Cash reserves	ln (1 + real cash reserves)
Debt ratio	real total assets / real total liabilities
Debt ratio squared	squared (real total assets / real total liabilities)
Liabilities banks	ln (1 + real liabilities towards banks)
Turnover	ln (1 + real turnover)
Value added	ln (1 + real value added)
Labor productivity	ln ((1 + real turnover) / (1 + number of employees))
Total factor productivity <sup>c</sup>	ln (total factor productivity)
Year	
year	Dummy for each year in our sample

Notes: <sup>a</sup> Regions were defined based on the 21 Croatian counties. Details are available on request. <sup>b</sup> All monetary variables were deflated using AMECO implicit price deflators with base in 2010. <sup>c</sup> Total factor productivity was estimated using Wooldridge (2009) methodology based on the production function approach using value added as output, labor and capital as inputs, and intermediate inputs to control for unobservables. As technologies used in the production process differ across different industries, TFP was estimated separately for each NACE Rev. 2 two-digit industry. Source: Authors' calculations.

Outputs are categorized in seven groups (Table 2): firm survival, output growth, labor inputs growth, capital inputs growth, intermediate inputs growth, productivity growth, and debt growth. All these are quite standard in the evaluation procedure (Srhoj, Škrinjarić, and Radas, 2019; Srhoj et al., 2019), except for Z-score, which we further elaborate. Altman Z-score (Altman, 2000) is used for the assessment of financial (in)stability of the firms included in this research. It is based on a combination of individual business performance indicators calculated from annual financial reports. The Altman Z-score is calculated with the following formula:

$$Z - score = 0,717X_1 + 0,847X_2 + 3,107X_3 + 0,420X_4 + 0,998X_5, \quad (1)$$

where  $X_1$  is ratio of working capital and total assets,  $X_2$  is ratio of retained earnings and total assets,  $X_3$  is ratio of earnings before interest and tax and total assets,  $X_4$  is ratio of market value of equity and total liabilities (book values), and  $X_5$  is ratio of sales and total assets. A score below 1.23 means it is likely the company is headed for bankruptcy, while companies with scores above 2.9 are not likely to go bankrupt. The values between these ranges represent the so-called “grey zone” (Zenzerović and Peruško, 2006).

Variable	Description
<i>Firm survival</i>	
Active on the market	Dummy if firm is still on the market in year $t + q$ , $q \in \{1, \dots, 5\}$
<i>Output growth</i>	
In total assets	Real total assets growth from $t - 1$ to $t + q$ , $q \in \{1, \dots, 5\}$ , $\ln (total\ assets_{t+q}) - \ln (total\ assets_{t-1})$

In sales (turnover)	Real turnover growth from $t - 1$ to $t + q$ , $q \in \{1, \dots, 5\}$ , $\ln (sales_{t+q}) - \ln (sales_{t-1})$
In value added	Real value added growth from $t - 1$ to $t + q$ , $q \in \{1, \dots, 5\}$ , $\ln (value\ added_{t+q}) - \ln (value\ added_{t-1})$
In profit/loss	Real profit/loss growth from $t - 1$ to $t + q$ , $q \in \{1, \dots, 5\}$ , $\ln \left( \frac{profit}{loss}_{t+q} \right) - \ln \left( \frac{profit}{loss}_{t-1} \right)$
<i>Labor inputs growth</i>	
In employees	Number of employees' growth from $t - 1$ to $t + q$ , $q \in \{1, \dots, 5\}$ , $\ln (employees_{t+q}) - \ln (employees_{t-1})$
In real average wage	Real average wage growth from $t - 1$ to $t + q$ , $q \in \{1, \dots, 5\}$ , $\ln (average\ wage_{t+q}) - \ln (average\ wage_{t-1})$
<i>Capital inputs growth</i>	
In capital	Real capital growth from $t - 1$ to $t + q$ , $q \in \{1, \dots, 5\}$ , $\ln (capital_{t+q}) - \ln (capital_{t-1})$
In bank loans	Real total liabilities towards banks growth from $t - 1$ to $t + q$ , $q \in \{1, \dots, 5\}$ , $\ln (liabilities_{t+q}) - \ln (liabilities_{t-1})$
<i>Intermediate inputs growth</i>	
In intermediate input costs	Real intermediate inputs growth from $t - 1$ to $t + q$ , $q \in \{1, \dots, 5\}$ , $\ln (intermediate\ costs_{t+q}) - \ln (intermediate\ costs_{t-1})$
<i>Productivity growth</i>	
In total factor productivity	Real total factor productivity growth from $t - 1$ to $t + q$ , $q \in \{1, \dots, 5\}$ , $\ln (TFP_{t+q}) - \ln (TFP_{t-1})$
In labor productivity	Real labor productivity growth from $t - 1$ to $t + q$ , $q \in \{1, \dots, 5\}$ , $\ln (labor\ productivity_{t+q}) - \ln (labor\ productivity_{t-1})$
<i>Debt growth</i>	
In debt ratio	Debt ratio growth from $t - 1$ to $t + q$ , $q \in \{1, \dots, 5\}$ , $\ln (debt\ ratio_{t+q}) - \ln (debt\ ratio_{t-1})$
In Z-score	Z-score growth from $t - 1$ to $t + q$ , $q \in \{1, \dots, 5\}$ , $\ln (Z\ -\ score_{t+q}) - \ln (Z\ -\ score_{t-1})$

Source: Authors' calculations.

## 5 Results

### 5.1 Descriptive Statistics and Matching Procedure

Descriptive statistics before and after matching are presented in Table A4 of the Appendix. The average firm in our sample is 9 years old (on the market) (9.0 control firms and 8.5 treated firms), located in Eastern Croatia (46 percent control firms and 32 percent treated

firms), micro-sized (77 percent control firms and 49 percent treated firms), from the agricultural sector (84 percent control firms and 73 percent treated firms), and mainly focused on the domestic market (71 percent control firms and 50 percent treated firms). Treated firms are also on average outperforming their potential controls in performance variables, most notably in the value of capital.

We used a probit model with a dummy variable indicating whether or not the firm  $i$  received the grant in time  $t, t \in \{2007, \dots, 2016\}$ , and with all firm performance variables and firm characteristics as independent variables (Table 1). To avoid the problem of simultaneity, the covariates enter the calculations with a lag of one period, i.e., with pre-treatment values. Estimation results are provided in Table A5. The estimated model was found to be statistically significant (Wald  $\chi^2$  test  $p < 0.001$ ) and the pseudo  $R^2$  shows that the model was able to explain 30.9 percent variance in the dependent variable. As the purpose of the probit model is to forecast the propensity score and not to interpret the coefficient estimates or their statistical significance, we do not interpret the specific findings obtained. The quality of the matched sample is our main objective here.

The propensity score is then used to find the control group composed of the nearest neighbors to the treated firms. Specifically, we combine exact matching and nearest neighbor matching. Since our analysis spans over the 2007–2016 period, during which the economic climate in Croatia changed dramatically (Croatian economy experienced a recession in the 2008–2014 period), we wanted to make sure to pair beneficiaries to those non-beneficiaries in very similar economic conditions. For this reason, treated and control observations were exactly matched on: year of receiving treatment, region of the firm, and NACE 2-digit sector; and then within each of these combinations of groups we used propensity score to find the nearest neighbor for each treated observation. After matching, Table A4 shows no significant differences in means of all covariates and a significant reduction in standardized bias. The observed empirical densities of the covariates and the propensity score can be accepted as sufficiently equal for treated and control firms. The necessary balancing property is thus achieved, implying that both samples are now comparable and therefore we are allowed to estimate ATETs and to interpret the obtained estimates.

## 5.2 Average Treatment Effect on the Treated

The ATET estimations are presented in Table 3, encompassing both firms' survival and performance outcomes. The results indicate a positive grant premium on the firm survival rate in one year after receiving the treatment. Grants also induce a positive output additionality in assets, turnover, and value added in both the short and the mid term after receiving the grant. The story is somewhat different for profit, which is significantly higher for grant recipients only in the short term (in the first year after the grant was obtained), and after that period, the

effect vanishes. The treatment also recorded a positive significant effect on employment throughout the analyzed period, even though effects on average wage were not significant. With regard to capital inputs, grants induce positive capital input additionality throughout the analyzed period, while growth rates in bank loans for treated firms are higher starting with the fourth year after undergoing treatment. Intermediate inputs show positive growth effects in both the short and the mid term. With regard to productivity, grants yield additionality in TFP and labor productivity in both the short and the mid term. Debt analysis reveals that treated firms managed to reduce their debt ratio in the first year following grant receipt, but this effect vanished in the mid term. Treatment effect in Z-score was not shown to be significant.

The placebo test with and without the normality assumption demonstrates the robustness of our original findings. All ATET estimates for the placebo-treated firms are not significantly different from zero (Table A6). Figure A1 in the Appendix shows the empirical distribution of the estimated ATETs for 10,000 replications of the placebo test computed for each statistically significant ATET effect in Table 3. The red line marks our baseline ATET estimates reported in Table 3, while green dashed lines represent the top and bottom 10 percent of the distribution. All estimated ATETs are in the far tails of their distribution, supporting the conclusion that there remains only a small probability that they occur by chance, thus corroborating that our baseline ATETs are attributable to the grants. Table A7 in the Appendix shows the results of the alternative matching approaches utilizing different matching methods; all findings confirm the robustness of the main results. Table A8 in the Appendix shows the results of the Rosenbaum bounds test, indicating that the majority of our significant effects are rather robust for up to 20 percent of hidden bias.

Outcome variables	ATET (s. e.)				
	<i>t + 1</i>	<i>t + 2</i>	<i>t + 3</i>	<i>t + 4</i>	<i>t + 5</i>
<i>Firm survival</i>					
Active on the market	0.044** (0.019)	0.061 (0.057)	0.035 (0.066)	0.026 (0.066)	0.001 (0.056)
<i>Output growth</i>					
In total assets	0.157*** (0.061)	0.152** (0.074)	0.160* (0.103)	0.147 (0.136)	0.179 (0.231)
In sales (turnover)	1.379*** (0.447)	1.635*** (0.533)	1.981*** (0.696)	1.536** (0.724)	1.195** (0.685)
In value added	0.780** (0.341)	0.815** (0.424)	1.381*** (0.529)	1.180** (0.626)	1.176*** (0.419)
In profit	0.651*** (0.262)	0.101 (0.284)	0.357 (0.481)	-0.398 (0.417)	0.571 (0.508)
<i>Labor inputs growth</i>					
In employees	0.282*** (0.081)	0.383*** (0.118)	0.502*** (0.155)	0.440*** (0.187)	0.412 (0.332)
In average wage	0.024 (0.089)	-0.114 (0.120)	-0.123 (0.140)	-0.111 (0.168)	-0.323* (0.213)
<i>Capital inputs growth</i>					
In capital	0.535*** (0.199)	0.454** (0.219)	0.513** (0.29)	0.520* (0.380)	0.587 (0.707)

In bank loans	-0.144 (0.442)	-0.326 (0.659)	-0.325 (0.782)	1.270* (0.903)	2.440** (1.442)
<i>Intermediate inputs growth</i>					
In intermediate input costs	0.960*** (0.242)	0.734*** (0.238)	0.811*** (0.299)	0.794** (0.376)	0.767* (0.529)
<i>Productivity growth</i>					
In total factor productivity	1.503*** (0.447)	1.845*** (0.564)	1.945*** (0.682)	1.701** (0.836)	0.657 (0.811)
In labor productivity	0.525* (0.333)	0.467 (0.395)	0.828** (0.475)	0.677 (0.557)	0.637** (0.332)
<i>Debt growth</i>					
In debt ratio	-0.101** (0.047)	-0.028 (0.053)	0.004 (0.076)	0.159* (0.101)	0.153 (0.170)
In Z-score	-0.087 (0.131)	-0.092 (0.163)	0.024 (0.152)	-0.174 (0.172)	-0.036 (0.173)

Notes: \*  $p < 0.1$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$ , one-sided  $p$ -values. “ $t$ ” denotes the year the firm received the grant. Standard errors ( $s. e.$ ) are based on Abadie and Imbens (2008).

Source: Authors' calculations.

We additionally estimated heterogeneous ATET using different firm characteristics: size, region, and trade orientation (Table A9 and Table A10). In terms of survival on the market, all the significant effects in the first year after obtaining the grant come from micro- and small-sized firms from the Central Croatia region, focused exclusively on the domestic market. In terms of firm size, the most significant and greatest effects are observed in micro-sized firms, particularly in survival on the market (only first year after obtaining the grant) and in output additionality. For the latter, compared to their large competitors, micro-sized firms recorded up to ten times greater growth rates in sales or value added, with significant increases in number of employees and obtained capital. They also managed to increase their TFP in the short and mid term, as well as to reduce their indebtedness. Moving on to results based on regional distribution of beneficiaries, the allocated grants seem to be the most effective in the Central Croatia region, which is somewhat surprising, given that traditionally the eastern parts of Croatia are more suitable for agriculture. Firms situated in Central Croatia show the greatest grant additionality in turnover, value added, and intermediate inputs. Also, these firms managed to boost their labor productivity and their TFP in the short and mid run, and to reduce their indebtedness in the short run. On the other hand, firms in Western Croatia managed to acquire more capital and recorded a significant increase in total assets. In terms of firms' trade orientation, there does not seem to be a clear pattern in which one group outperforms the other. Firms concentrating solely on the domestic market show greater survival effects (only in the first year after treatment) and greater increase in turnover and capital. On the other hand, firms that are both exporters and importers managed to increase their value added, employ additional workers, increase their average wage, and boost their labor productivity and TFP.

### 5.3 Cost-Benefit Analysis

The estimated treatment effects (Table 3) enable us to make a cost-benefit analysis with common “back-of-the-envelope” calculation (Czarnitzki and Lopes-Bento, 2013). On the cost side, the amount of public funds provided for 157 SAPARD/IPARD grants was 64.9 million EUR (2007–2016 period, Table A2). On the yearly benefits side, the awarded grants led to an average increase in turnover at times  $t + 1$ ,  $t + 3$ , and  $t + 5$  of 0.9 million EUR, 1.3 million EUR, and 0.8 million EUR per firm, respectively. Multiplying this with the number of awarded grants (157 awarded grants, Table A2) amounts to 140.7 million EUR, 202.1 million EUR, and 121.8 million EUR at times  $t + 1$ ,  $t + 3$ , and  $t + 5$ , respectively. This implies that the estimated benefits of the grant schemes outweigh the grant scheme costs by 2.2, 3.1, and 1.9 times in the short and mid term after the grants were distributed. These benefits are quite similar to the three times higher value added created by an export promotion policy in Denmark (Munch and Schaur, 2018) or by women entrepreneurship policies in Croatia (Srhoj et al., 2019). We can thus speculate that the grants had the greatest effect in the mid term, three years after they were distributed.

Outcome variables	$t + 1$	$t + 2$	$t + 3$	$t + 4$	$t + 5$
Real assets	254,709	246,514	246,514	- <sup>a</sup>	-
Real turnover	895,955	1,062,244	1,287,040	997,864	776,012
Real value added	286,569	299,527	507,168	433,350	431,906
Real profit	7,974	-	-	-	-
Number of employees	3	4	6	5	-
Real average wage	-	-	-	-	-
Real capital	614,276	520,880	588,831	597,192	-
Real liabilities towards banks	-	-	-	1,030,955	1,980,383
Real intermediate inputs	698,502	534,017	589,831	577,548	558,179

Notes: We estimate the effects for the sample of treated firms in our analysis. All monetary variables are expressed in EUR. 1 EUR = 7.42 Croatian kuna (HRK). “ $t$ ” denotes the year the firm received the grant. <sup>a</sup> We report only significant effects. Source: Authors’ calculations.

## 6 Discussion and Conclusion

The aim of this research was to evaluate the impact of public grants from the pre-accession SAPARD and IPARD programs on the business performance of enterprises in the agri-food sector in Croatia. The study also responds to the perceived lack of assessment of the net impact of pre-accession programs on beneficiaries using a counterfactual approach. The basis of the impact assessment is a comparison of selected indicators of sustainability, productivity, and business performance between the beneficiaries of the grants (treated firms) and sufficiently similar firms that did not use the grants (untreated or control firms). A combination of propensity score matching and difference-in-difference method was used, and the analysis period covered years  $t - 1$  to  $t + 5$ , with  $t$  indicating the year the grant was received.



Our results suggest that SAPARD and IPARD grants had different impacts with respect to the period considered, the type of performance indicator, and the group of companies. An overall positive output additionality in all five years after treatment was found for turnover, value added, and total assets. The beneficiaries of the grants also saw higher growth in employment, TFP, labor productivity, and capital input throughout the five years. In some years, the grants affected higher growth in bank loans ( $t + 4$ ,  $t + 5$ ) and profits ( $t + 1$ ), while decrease in the debt ratio was significant in year  $t + 1$ . The treatment did not affect the wage growth and financial stability of the companies as measured by Altman's Z-score. The results obtained largely justify the purpose of the grants, which was the modernization and upgrading of production capacities. Looking at the results by groups of companies, it is interesting that the effect of the grants on survival on the market in year  $t + 1$  is concentrated on micro and small enterprises that are focused on the domestic market and located in Central Croatia. Micro-sized enterprises that received grants saw ten times higher growth in sales and value added than large enterprises. For micro-sized enterprises, employment and TFP also increased more, while indebtedness decreased. In terms of regional differences, the grants appear to have had the greatest impact in Central Croatia, although Eastern Croatia is the one traditionally agricultural.

Despite some circumstances that could lead to opposite conclusions (such as the demanding approval procedure for the grants, relatively modest funding compared to generous national support programs, expensive pre-financing loans, and the unfavorable economic situation), the results of this study suggest that the pre-accession programs in Croatia had an impact on the beneficiaries' growth and business performance indicators, and that this impact was positive.

This paper provides an insight into the net impact of pre-accession grants in Croatia, and thus promotes the application of similar research in other EU candidate countries where the same or similar funds are implemented. The study also demonstrates the applicability of the selected methods in the circumstances of available data at the national level. In addition, we suggest the same approach to be applied for EU programs available to Croatia as an EU member state, such as the Rural Development Program.

One of the limitations of this research is related to the possibility that an essential unobserved covariate was not included in the analysis. Therefore, future research should look for new enterprise characteristics, which could be related to organizational and human resources as well, and which may play an important role, especially in small enterprises. A standard limitation is that we did not conduct a general equilibrium analysis, but an average treatment effect analysis only. There might be spillovers to other firms, such as consultancies, suppliers of equipment, etc. which we did not estimate. The quality of the research could be raised by including the number of points per application during the tender, as rejected applicants could represent an additional control group. Finally, this study includes enterprises that issue financial statements, i.e., are subject to profit tax, meaning that family farms and similar enterprises, which make up by far the largest number of farmers in Croatia, are not included. Consequently, similar research at a comprehensive level requires finding alternative sources of information about assets, production, sales, and business performance.

# Appendix A

Grant scheme name	Subsidized activities	Applicant requirements	Min. and max. amounts
<p>Table A1 <b>SAPARD/IPARD Grant Scheme(s) Description</b></p> <p>SAPARD Program, Measure 1 – Investments in agricultural holdings</p>	<ul style="list-style-type: none"> <li>- Investment in construction and/or reconstruction of stables for cattle, pigs, and poultry, including equipment facilities;</li> <li>- Investment in mechanization of milk production, milking machines, on-farm milk cooling and storage equipment, and development of suitable spaces for milk handling and storage;</li> <li>- Investment in animal manure, slurry reservoirs, and specialized manure transportation equipment;</li> <li>- Investment in construction and/or reconstruction of greenhouses;</li> <li>- Investment in equipment of greenhouses;</li> <li>- Investment in construction and/or equipment of storage facilities (including those with ULO conditions);</li> <li>- Investment in equipment for harvesting, handling, and packaging of fruit and vegetables (on-farm);</li> <li>- Investment in on-farm irrigation facilities (including computer equipment) for fruits and vegetables;</li> <li>- Investment in construction, reconstruction and/or equipment of on-farm drying and storage facilities for cereals and oil-crops.</li> </ul>	<p>GENERAL applicant requirements:</p> <ul style="list-style-type: none"> <li>- Must be registered in the Farm Register;</li> <li>- Must be registered in the VAT Register;</li> <li>- No outstanding national tax debts;</li> <li>- Should have appropriate experience in agriculture;</li> <li>- The farm had to meet national standards at the beginning of the investment.</li> </ul>	<ul style="list-style-type: none"> <li>- The amount of public aid is 50% of total eligible expenditure;</li> <li>- The amount of public aid per beneficiary is limited to the ceiling of 0.3 million EUR (about 2.5 million HRK).</li> </ul>
<p>SAPARD Program, Measure 2 – Improving the processing and marketing of agricultural and fisheries products</p>	<ul style="list-style-type: none"> <li>- Investment in construction and/or reconstruction, upgrading, and/or equipment of facilities of milk and dairy plants;</li> <li>- Investment in reconstruction, upgrading, and/or equipment of facilities of slaughterhouses;</li> <li>- Investment in existing animal rendering plants and/or the construction and/or reconstruction and/or equipment of centers for collecting animal waste;</li> <li>- Investment in construction and/or reconstruction and/or equipment of facilities of fish processing plants;</li> <li>- Investment in equipment for cooling, processing, packaging, and marketing of fishery products and for waste reduction in production including software;</li> <li>- Investment in construction and/or equipment of facilities of shellfish purification centers;</li> <li>- Investment in construction and/or reconstruction and/or equipment of facilities of fruit and vegetable processing plants.</li> </ul>	<ul style="list-style-type: none"> <li>- The applicant must be registered in the VAT Register;</li> <li>- The applicant has no outstanding national tax debts;</li> <li>- The applicant must be registered for the activity for which they applied;</li> <li>- The applicants must be privately owned companies or with a share of state ownership not exceeding 25%;</li> <li>- Slaughterhouses, dairies, and fish processing plants with an EU export number are not eligible for investment.</li> </ul>	<ul style="list-style-type: none"> <li>- The amount of public aid is 50% of total eligible expenditure;</li> <li>- The amount of public aid per beneficiary is limited to the ceiling of 1.6 million EUR (about 10.0 million HRK).</li> </ul>
<p>IPARD Program, Measure 101 – Investments in agricultural holdings to reconstruct and to upgrade to Community standards</p>	<ul style="list-style-type: none"> <li>- Investment in construction and/or reconstruction and/or equipment of stables/poultry houses, facilities and equipment for waste management, waste water treatment, and air pollution prevention measures;</li> <li>- Construction and/or reconstruction of manure storage capacities including specific equipment of facilities for handling and usage of animal manure;</li> <li>- Investment in agricultural machinery (including tractors) and equipment;</li> <li>- Investment in construction and/or equipping of biogas plants for the production of energy from renewable sources (fertilizers and other organic waste) on farms;</li> <li>- Investment in construction and equipment for fixed fencing of lawns;</li> <li>- Investment in construction and/or reconstruction and/or equipment of facilities for greenhouses (covered by glass or plastic) for fruits and vegetables;</li> <li>- Investment in equipment of facilities for specialized harvesting, sorting, and packaging of</li> </ul>	<ul style="list-style-type: none"> <li>- The applicant must be registered in the Farm Register;</li> <li>- The applicant must be registered in the VAT Register;</li> <li>- Share of state ownership or ownership of local self-government units must not exceed 25%;</li> <li>- The applicant has no outstanding national tax debts;</li> <li>- The applicant should have appropriate experience in agriculture;</li> <li>- The farm had to meet national standards at the beginning of the investment;</li> <li>- The investment must be made in a rural area (whole</li> </ul>	<ul style="list-style-type: none"> <li>- The grant is 50-75% of the value of the eligible investment;</li> <li>- Minimum amount of eligible investment is 13.500 EUR (about 100.000 HRK);</li> <li>- Maximum amount of eligible expenditure is 0.9 million EUR (about 6.6 million HRK), with the exception of the egg</li> </ul>

	<p>fruit and vegetables, including table grapes;</p> <ul style="list-style-type: none"> <li>- Investment in construction and/or reconstruction and/or equipment of storage facilities for fruits and vegetables, including ULO capacities;</li> <li>- Investment in on-farm systems for protection against hail (including computer equipment) for orchards and table grapes;</li> <li>- Investment in first setting up of new and/or restructuring and conversion of existing orchards and table-grape groves;</li> <li>- Investment in restructuring and conversion of existing olive groves and wine-grape groves;</li> <li>- Investment in on-farm irrigation systems (open field) for permanent crops and vegetables;</li> <li>- Investment in construction and/or reconstruction and/or equipment of facilities for storage and drying of grains and oil seeds.</li> </ul>	<p>Republic of Croatia except City of Zagreb and Sesvete municipality).</p>	<p>sector with a maximum amount of 2.0 million EUR (about 14.6 million HRK).</p>
<p>IPARD Program, Measure 103 – Processing and marketing of agricultural and fishery products</p>	<ul style="list-style-type: none"> <li>- Investment in construction and/or reconstruction and/or equipment of facilities of existing milk and dairy processing plants, including cooling equipment for raw milk in collection points;</li> <li>- Investment in specialized transport vehicles for raw milk;</li> <li>- Investment in reconstruction and/or equipment of facilities of existing slaughterhouses, including equipment of facilities for cooling and meat packaging, and disposal of by-products of animal origin;</li> <li>- Investment in construction and/or reconstruction and/or equipment of facilities of intermediate plants;</li> <li>- Investment in construction and/or reconstruction and/or equipment of facilities for fish, crustaceans, and live shellfish processing plants, including equipment for cooling, cutting, drying, fuming, and packing of products and disposal of by-products of animal origin not intended for human consumption;</li> <li>- Investments necessary for compliance with the IPPC Directive;</li> <li>- Investment in wastewater treatment equipment, air filtration, and refrigeration systems;</li> <li>- Investment in renewable energy plants (construction and equipment);</li> <li>- Investment in construction and/or reconstruction and/or equipping of facilities for the processing of fruit and/or vegetables, olives (excluding olive oil), aromatic, spicy, and medicinal herbs, and mushrooms, including the production of juices, vinegar, and fruit wines (excluding wine from grapes), and pumpkin oil production;</li> <li>- Investment in equipment of facilities (equipment for filtration, stabilization, lines for bottling of wine, automatic labelling, and packing) of wineries;</li> <li>- Investment in laboratory equipment for basic chemical analysis of olive oil;</li> <li>- Investment in olive processing equipment and marketing of olive oil;</li> <li>- Investment in equipment for utilization of olive pomace for processing into compost.</li> </ul>	<ul style="list-style-type: none"> <li>- The eligible applicants are crafts, companies, and cooperatives;</li> <li>- The applicant must be registered for the activity for which they applied;</li> <li>- The applicant must be registered in the VAT Register;</li> <li>- The applicant has no outstanding national tax debts;</li> <li>- The eligible applicant must be: <ul style="list-style-type: none"> <li>1) In the rank of micro, small or medium-sized enterprises with less than 25% of state ownership or ownership of local (regional) self-government units or the City of Zagreb;</li> <li>2) In the rank of enterprises with less than 750 employees or with an annual turnover not exceeding 200 million EUR with less than 25% of state ownership or ownership of local (regional) self-government units or the City of Zagreb;</li> </ul> </li> <li>- The facilities had to meet national standards at the beginning of the investment.</li> </ul>	<ul style="list-style-type: none"> <li>- The grant is 50% of the value of the eligible investment;</li> <li>- Minimum amount of eligible investment is 33,800 EUR (250,000 HRK), with the exception of the wine sector with a minimum amount of 13,500 EUR (100,000 HRK);</li> <li>- Maximum amount of eligible expenditure is 3.1 million EUR (21.9 million HRK), with the exception of the olive oil sector with a maximum amount of 0.5 million EUR (3.7 million HRK).</li> </ul>

*Note: All monetary variables are expressed in EUR. 1 EUR = 7.42 Croatian kuna (HRK).*

*Source: Ordinances on the Implementation of the SAPARD Measures 1 and 2 (OG 56/06, 82/06, 85/06, 32/07, 17/08, 89/08, 20/09 and 116/09) and Ordinances on the Implementation of the IPARD Measure 101 and Measure 103 (OG 146/09, 150/09, 58/10, 10/11, 116/11, 54/12, 68/12, 24/13, 36/14, 83/14).*

Year	Grant program	All grants										Final sample				
		Grants	Amount	Mean	S. d.	Min.	Max.	Grants	Amount	Mean	S. d.	Min.	Max.			
2007	SAPARD	3	1,236,975	412,325	164,444	253,147	581,571	1	581,571	581,571	0	581,571	581,571			
2008	SAPARD	8	2,648,802	331,100	151,159	25,417	487,148	5	1,702,396	340,479	88,253	225,866	474,110			
2009	SAPARD	13	9,192,424	707,110	512,522	90,743	1,347,709	8	5,268,709	658,589	532,735	90,743	1,347,709			
2010	IPARD	1	379,316	379,316	0	379,316	379,316	-	-	-	-	-	-			
2011	IPARD	4	1,932,933	483,233	624,688	72,302	1,408,287	1	142,644	142,644	0	142,644	142,644			
2012	IPARD	20	9,863,508	493,175	431,662	27,630	1,481,138	12	6,605,878	550,490	427,975	27,630	1,432,888			
2013	IPARD	32	13,972,533	436,642	508,824	22,236	1,519,609	26	11,345,924	436,382	546,638	22,236	1,519,609			
2014	IPARD	21	6,444,351	306,874	340,196	28,604	1,535,175	17	5,706,901	335,700	365,698	28,604	1,535,175			
2015	IPARD	25	8,394,460	335,778	277,241	28,025	1,083,820	19	7,086,397	372,968	286,930	28,025	1,083,820			
2016	IPARD	30	10,791,951	359,732	294,536	45,205	1,218,648	25	9,122,289	364,892	304,436	51,737	1,218,648			
	<b>TOTAL</b>	<b>157</b>	<b>64,857,253</b>	<b>413,104</b>	-	-	-	<b>114</b>	<b>47,562,709</b>	<b>417,217</b>	-	-	-			

Note: All monetary variables are expressed in EUR. 1 EUR = 7.42 Croatian kuna (HRK).

Source: SAPARD and IPARD Monitoring Tables, Managing Authority, Ministry of Agriculture.

Table A3 SAPARD/IPARD Grant Scheme(s) Descriptive Statistics by Firm Characteristics						
	Grants	Amount	Mean	S. d.	Min.	Max.
<i>Firm size</i>						
Micro	56	14,450,059	258,037	201,779	22,236	1,088,466
Small	36	16,311,443	453,096	418,643	27,630	1,512,949
Medium	17	12,940,009	761,177	498,932	158,257	1,535,175
Large	5	3,861,198	772,239	693,723	82,518	1,519,609
<i>Firm sector</i>						
Agriculture	83	26,821,551	323,151	319,333	22,236	1,512,949
Food manufacturing	27	19,106,472	707,647	467,342	166,359	1,535,175
Beverage manufacturing	4	1,634,686	408,672	667,234	27,630	1,404,172
<i>Firm region</i>						
Zagreb	16	6,039,850	377,491	208,589	81,881	853,494
Western Croatia	8	5,351,342	668,918	583,002	22,236	1,515,263
Eastern Croatia	37	13,407,785	362,373	364,660	28,604	1,535,175
Central Croatia	38	12,517,125	329,398	333,289	27,630	1,519,609
Southern Croatia	15	10,246,607	683,107	564,562	43,934	1,517,082
<i>Firm trade orientation</i>						
Domestic only	57	103,771,985	1,820,561	1,417,973	164,992	8,076,420
Importer only	14	46,719,813	3,337,130	2,929,622	687,501	10,632,029
Exporter only	10	40,840,937	4,084,094	3,536,899	747,837	11,243,250
Exporter and importer	33	161,582,564	4,896,442	3,813,440	205,018	11,391,000
<b>TOTAL</b>	<b>114</b>	<b>47,562,709</b>	<b>417,217</b>			

Note: All monetary variables are expressed in EUR. 1 EUR = 7.42 Croatian kuna (HRK).

Source: Authors' calculations.

Table A4 Balance of Covariates Used in the Analysis (common support applies after matching)

Variables	Before matching						After matching						
	Control		Treated		Std. bias (%)	Difference	Control		Treated		Difference	Std. bias (%)	% reduction in std. bias
	Mean (s. d.)	(n × T = 5,112) <sup>a</sup>	Mean (s. d.)	(n = 114)			Mean (s. d.)	(n = 114)	Mean (s. d.)	(n = 114)			
Year <sup>b</sup>													
2007	0.00 (0.05)		0.01 (0.09)		8.30	0.01	0.01 (0.09)		0.01 (0.09)		0.00	0.00	100.00
2008	0.06 (0.24)		0.04 (0.21)		-8.20	-0.02	0.04 (0.21)		0.04 (0.21)		0.00	0.00	100.00
2009	0.06 (0.25)		0.07 (0.26)		2.30	0.01	0.07 (0.26)		0.07 (0.26)		0.00	0.00	100.00
2011	0.03 (0.16)		0.01 (0.09)		-13.30	-0.02	0.01 (0.09)		0.01 (0.09)		0.00	0.00	100.00
2012	0.16 (0.37)		0.11 (0.31)		-16.80	-0.06	0.11 (0.31)		0.11 (0.31)		0.00	0.00	100.00
2013	0.20 (0.40)		0.23 (0.42)		7.60	0.03	0.23 (0.42)		0.23 (0.42)		0.00	0.00	100.00
2014	0.16 (0.37)		0.15 (0.36)		-4.00	-0.01	0.14 (0.35)		0.15 (0.36)		0.01	2.40	40.00
2015	0.18 (0.38)		0.17 (0.37)		-2.20	-0.01	0.18 (0.38)		0.17 (0.37)		-0.01	-2.30	-4.30
2016	0.15 (0.35)		0.22 (0.42)		18.90	0.07**	0.22 (0.42)		0.22 (0.42)		0.00	0.00	100.00
Firm region <sup>b</sup>													
Zagreb region	0.11 (0.31)		0.14 (0.35)		10.50	0.03	0.16 (0.37)		0.14 (0.35)		-0.02	-5.30	49.20
Western Croatia	0.05 (0.21)		0.07 (0.26)		9.90	0.02	0.07 (0.26)		0.07 (0.26)		0.00	0.00	100.00
Eastern Croatia	0.46 (0.50)		0.32 (0.47)		-28.50	-0.14***	0.32 (0.47)		0.32 (0.47)		0.01	1.80	93.60
Central Croatia	0.28 (0.45)		0.33 (0.47)		12.20	0.06	0.33 (0.47)		0.33 (0.47)		0.00	0.00	100.00
Southern Croatia	0.11 (0.31)		0.13 (0.34)		7.40	0.02	0.12 (0.33)		0.13 (0.34)		0.01	2.70	63.70
Firm size <sup>b</sup>													
Micro	0.77 (0.42)		0.49 (0.50)		-60.10	-0.28***	0.45 (0.50)		0.49 (0.50)		0.04	9.50	84.30
Small	0.18 (0.38)		0.32 (0.47)		31.60	0.14***	0.37 (0.48)		0.32 (0.47)		-0.05	-12.30	61.10
Medium	0.04 (0.20)		0.15 (0.36)		37.40	0.11***	0.16 (0.37)		0.15 (0.36)		-0.01	-3.00	91.90
Large	0.01 (0.09)		0.04 (0.21)		21.90	0.04***	0.03 (0.16)		0.04 (0.21)		0.02	11.00	50.00
Firm sector <sup>b</sup>													
Agriculture, forestry, and fishing	0.84 (0.36)		0.73 (0.45)		-28.20	-0.12***	0.70 (0.46)		0.73 (0.45)		0.03	6.50	77.10
Food manufacturing	0.15 (0.35)		0.24 (0.43)		22.80	0.09***	0.26 (0.44)		0.24 (0.43)		-0.03	-6.70	70.50
Beverage manufacturing	0.01 (0.10)		0.04 (0.18)		17.40	0.03***	0.04 (0.18)		0.04 (0.18)		0.00	0.00	100.00
Firm trade <sup>b</sup>													
Domestic only	0.71 (0.45)		0.50 (0.50)		-44.70	-0.21***	0.53 (0.50)		0.50 (0.50)		-0.03	-5.50	87.70
Exporter only	0.08 (0.26)		0.09 (0.28)		4.50	0.01	0.08 (0.27)		0.09 (0.28)		0.01	3.20	28.20

Importer only	0.12 (0.32)	0.12 (0.33)	0.00	1.10	0.16 (0.37)	0.12 (0.33)	-0.04	-10.70	-854.60
Exporter and importer	0.09 (0.29)	0.29 (0.46)	0.2***	51.90	0.24 (0.43)	0.29 (0.46)	0.05	13.80	73.40
Firm performance									
Firm age	9.02 (5.92)	8.53 (6.21)	-0.49	-8.10	9.04 (6.23)	8.53 (6.21)	-0.52	-8.50	-4.80
Firm age (squared)	116.38 (129.78)	110.98 (132.71)	-5.4	-4.10	120.32 (141.3)	110.98 (132.71)	-9.34	-7.10	-73.00
(ln) Labor	1.83 (1.21)	2.58 (1.64)	0.75***	51.90	2.66 (1.65)	2.58 (1.64)	-0.09	-6.10	88.20
(ln) Real average wage	10.58 (0.75)	10.22 (2.3)	-0.37***	-21.40	10.53 (1.12)	10.22 (2.3)	-0.32	-18.40	13.70
(ln) Real capital	14.27 (2.05)	15.83 (2.29)	1.56***	71.70	15.72 (2.09)	15.83 (2.29)	0.11	4.90	93.20
(ln) Real cash reserves	9.76 (3.37)	11.1 (2.61)	1.34***	44.60	10.85 (2.8)	11.1 (2.61)	0.25	8.40	81.20
(ln) Debt ratio	-0.45 (0.74)	-0.39 (0.52)	0.06	9.80	-0.41 (0.57)	-0.39 (0.52)	0.02	3.80	61.10
(ln) Real liabilities towards banks	10.13 (6.49)	13.2 (5.79)	3.07***	49.80	12.40 (6.50)	13.2 (5.79)	0.8	13.00	73.80
(ln) Real value added	14.07 (2.27)	12.77 (5.65)	-1.31***	-30.30	14.21 (4.31)	12.77 (5.65)	-1.44**	-33.50	-10.40
(ln) Real turnover	14.1 (3.07)	13.5 (5.47)	-0.6**	-13.50	14.49 (4.5)	13.5 (5.47)	-0.99	-22.30	-65.50
(ln) Labor productivity	12.25 (1.66)	10.32 (4.42)	-1.93***	-57.80	11.57 (3.24)	10.32 (4.42)	-1.25**	-37.50	35.10
(ln) TFP	11.47 (1.89)	10 (4.55)	-1.46***	-42.00	11.19 (3.82)	10.00 (4.55)	-1.19**	-34.10	18.80

Notes: \*  $p < 0.1$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$ . <sup>a</sup> This includes both cross section and time dimension. Without time dimension there are 3,153 potential controls. <sup>b</sup> Differences in categorical variables were tested using the  $\chi^2$  test.

Source: Authors' calculations.

Table A5 Results of the Probit Model

Variable <sup>a</sup>	Estimated coefficients	Standard errors	Marginal effects <sup>b</sup>	Standard errors
Firm age	-0.031**	(0.014)	-0.001**	(0.000)
Firm age (squared)	0.000	(0.000)	0.000	(0.000)
(ln) Labor	0.317	(0.418)	0.006	(0.008)
(ln) Real average wage	-0.259***	(0.051)	-0.005***	(0.001)
(ln) Real capital	0.228***	(0.039)	0.004***	(0.001)
(ln) Real cash reserves	0.055***	(0.018)	0.001***	(0.000)
(ln) Debt ratio	0.019	(0.079)	0.000	(0.001)
(ln) Real liabilities towards banks	0.026***	(0.010)	0.000***	(0.000)
(ln) Real value added	-0.530	(0.395)	-0.010	(0.007)
(ln) Real turnover	0.018	(0.025)	0.000	(0.000)
(ln) Labor productivity	0.082	(0.433)	0.002	(0.008)
(ln) TFP	0.317**	(0.127)	0.006**	(0.002)
N		12,032		
McFadden pseudo R <sup>2</sup>		0.309		

Notes: \*  $p < 0.1$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$ , two-sided  $p$ -values. <sup>a</sup> In this model, we also control for effects of years, ownership, region, sector, size, and trade exposure. However, for the sake of brevity and presentation purposes, these results are available on request. <sup>b</sup> These are average marginal effects.

Source: Authors' calculations.



Outcome variables	ATEE (s. e.)				
	t + 1	t + 2	t + 3	t + 4	t + 5
<i>Firm survival</i>					
Active on the market	-0.018 (0.024)	-0.026 (0.059)	0.018 (0.066)	0.035 (0.065)	0.026 (0.055)
<i>Output growth</i>					
In total assets	0.026 (0.053)	0.086 (0.080)	0.022 (0.086)	0.021 (0.116)	0.194 (0.209)
In sales (turnover)	0.255 (0.320)	0.682 (0.532)	-0.107 (0.496)	-0.532 (0.626)	-0.063 (0.791)
In value added	0.286 (0.32)	0.558 (0.481)	-0.301 (0.387)	-0.298 (0.509)	0.401 (0.471)
In profit	-0.314 (0.263)	-0.362 (0.342)	-0.012 (0.435)	0.247 (0.431)	-0.359 (0.773)
<i>Labor inputs growth</i>					
In employees	-0.058 (0.082)	-0.115 (0.128)	-0.236 (0.193)	-0.039 (0.213)	0.147 (0.372)
In average wage	-0.015 (0.094)	0.077 (0.128)	-0.009 (0.143)	-0.094 (0.141)	-0.164 (0.216)
<i>Capital inputs growth</i>					
In capital	0.177 (0.201)	0.541 (0.523)	0.086 (0.161)	0.193 (0.288)	0.954 (0.848)
In bank loans	0.643 (0.513)	0.657 (0.768)	0.882 (0.744)	1.191 (1.347)	3.117 (2.946)
<i>Intermediate inputs growth</i>					
In intermediate input costs	-0.112 (0.175)	0.119 (0.262)	-0.184 (0.364)	0.153 (0.466)	0.105 (0.549)
<i>Productivity growth</i>					
In total factor productivity	0.296 (0.348)	0.558 (0.463)	0.265 (0.436)	-0.531 (0.466)	0.129 (0.389)
In labor productivity	0.304 (0.304)	0.610 (0.544)	-0.077 (0.311)	-0.282 (0.408)	0.239 (0.351)
<i>Debt growth</i>					
In debt ratio	-0.005 (0.047)	-0.062 (0.071)	-0.025 (0.097)	0.012 (0.150)	0.077 (0.263)
In Z-score	0.179 (0.153)	0.079 (0.162)	0.053 (0.191)	0.153 (0.203)	0.494 (0.391)

Notes: \*  $p < 0.1$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$ , one-sided  $p$ -values. "t" denotes the year the firm received the grant. Standard errors (s. e.) are based on Abadie & Imbens (2008). Balancing property after matching is satisfied. We do not report this for brevity, but the results are available on request.  
Source: Authors' calculations.

Table A7 Result Comparison between Baseline Model and Other Matching Algorithms

Variables	NN (1)	NN (2)	NN (3)	NN (4)	NN (2)	NN (3)	NN (4)	Radius
	Baseline				Caliper	Caliper	Caliper	Caliper
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>Firm survival</i>								
In $t + 1$	0.031**	0.029***	0.029***	0.031**	0.029***	0.029***	0.045***	0.031**
In $t + 2$	0.057	0.056	0.055	0.057	0.056	0.055	0.056*	0.057
In $t + 3$	0.057	0.050	0.048	0.057	0.05	0.048	0.064*	0.057
In $t + 4$	0.053	0.041	0.042	0.053	0.041	0.042	0.074*	0.053
In $t + 5$	0.009	0.012	0.015	0.009	0.012	0.015	0.039	0.009
<i>Output growth</i>								
In total assets at $t + 1$	0.088***	0.079***	0.086***	0.088***	0.079***	0.086***	0.123***	0.088***
In total assets at $t + 2$	0.175***	0.145***	0.150***	0.175***	0.145***	0.150***	0.198***	0.175***
In total assets at $t + 3$	0.191***	0.151**	0.162**	0.191***	0.151**	0.162**	0.217***	0.191***
In total assets at $t + 4$	0.163**	0.139*	0.157*	0.163**	0.139*	0.157*	0.296***	0.163**
In total assets at $t + 5$	0.135	0.163*	0.196*	0.135	0.163*	0.196*	0.337***	0.135
In sales at $t + 1$	0.101	0.059	0.119	0.101	0.059	0.119	0.337*	0.102
In sales at $t + 2$	1.330***	1.351***	1.343***	1.330***	1.351***	1.343***	1.898***	1.330***
In sales at $t + 3$	1.654***	1.688***	1.854***	1.654***	1.688***	1.854***	2.453***	1.654***
In sales at $t + 4$	2.074***	2.279***	2.374***	2.074***	2.279***	2.374***	2.769***	2.074***
In sales at $t + 5$	1.602***	2.010***	2.039***	1.602***	2.010***	2.039***	2.385***	1.602***
In value added at $t + 1$	0.642	0.693*	1.031**	0.642	0.693*	1.031**	1.623***	0.642
In value added at $t + 2$	0.726***	0.668***	0.699***	0.726***	0.668***	0.699***	1.183***	0.726***
In value added at $t + 3$	0.805**	0.893***	0.971***	0.805**	0.893***	0.971***	1.504***	0.805**
In value added at $t + 4$	1.248***	1.322***	1.298***	1.248***	1.322***	1.298***	1.686***	1.248***
In value added at $t + 5$	1.106**	1.311***	1.326***	1.106**	1.311***	1.326***	1.671***	1.106**
In profit at $t + 1$	0.831*	0.895**	1.029***	0.831*	0.895**	1.029***	1.46***	0.831*
In profit at $t + 2$	0.532***	0.451**	0.470**	0.532***	0.451**	0.470**	0.567***	0.532***
In profit at $t + 3$	0.117	0.078	0.052	0.117	0.078	0.052	0.354*	0.117
In profit at $t + 4$	0.414	0.368	0.394	0.414	0.368	0.394	0.351	0.414
In profit at $t + 5$	-0.388	-0.297	-0.114	-0.388	-0.297	-0.114	-0.108	-0.388
In employees at $t + 1$	0.354	0.243	0.232	0.354	0.243	0.232	0.323	0.354
<i>Employees growth</i>								

In employees at t + 2	0.269***	0.261***	0.243***	0.269***	0.261***	0.249***	0.291***	0.269***
In employees at t + 3	0.329***	0.327***	0.333***	0.329***	0.327***	0.333***	0.334***	0.329***
In employees at t + 4	0.425***	0.436***	0.443***	0.425***	0.436***	0.443***	0.375***	0.425***
In employees at t + 5	0.416***	0.428***	0.44***	0.416***	0.428***	0.440***	0.389***	0.416***
In average wage at t + 1	0.360	0.295	0.322	0.360	0.295	0.322	0.261	0.360
In average wage at t + 2	0.024	-0.008	0.001	0.024	-0.008	0.001	0.079*	0.024
In average wage at t + 3	-0.087	-0.126*	-0.104	-0.087	-0.126*	-0.104	0.095*	-0.087
In average wage at t + 4	-0.116	-0.186*	-0.138	-0.116	-0.186*	-0.138	-0.001	-0.116
In average wage at t + 5	-0.145	-0.150	-0.088	-0.145	-0.15	-0.088	0.001	-0.145
<i>Capital growth</i>								
In capital at t + 1	-0.447**	-0.478**	-0.384**	-0.447**	-0.478**	-0.384**	-0.243*	-0.447**
In capital at t + 2	0.633***	0.636***	0.619***	0.633***	0.636***	0.619***	0.629***	0.633***
In capital at t + 3	0.605***	0.517***	0.612***	0.605***	0.517***	0.612***	0.756***	0.605***
In capital at t + 4	0.553**	0.510**	0.838***	0.553**	0.510**	0.838***	0.980***	0.553**
In capital at t + 5	0.575*	0.587*	0.872**	0.575*	0.587*	0.872**	1.093***	0.575*
In bank loans at t + 1	0.841	0.753	0.776	0.841	0.753	0.776	1.246**	0.841
In bank loans at t + 2	0.397	0.457	0.431	0.397	0.457	0.431	0.548**	0.397
In bank loans at t + 3	0.586	0.552	0.462	0.586	0.552	0.462	0.422	0.586
In bank loans at t + 4	1.099*	1.116**	0.990**	1.099*	1.116**	0.990**	1.123***	1.099*
In bank loans at t + 5	2.271***	2.195***	1.899***	2.271***	2.195***	1.899***	1.549***	2.271***
<i>Intermediate inputs growth</i>								
In intermediate input costs at t + 1	3.689***	3.182***	3.111***	3.689***	3.182***	3.111***	3.024***	3.689***
In intermediate input costs at t + 2	0.979***	0.941***	0.898***	0.979***	0.941***	0.898***	0.990***	0.979***
In intermediate input costs at t + 3	0.791***	0.769***	0.800***	0.791***	0.769***	0.800***	0.860***	0.791***
In intermediate input costs at t + 4	0.793***	0.820***	0.819***	0.793***	0.820***	0.819***	0.942***	0.793***
In intermediate input costs at t + 5	0.752***	0.839***	0.861***	0.752***	0.839***	0.861***	1.014***	0.752***
<i>Productivity growth</i>								
In TFP at t + 1	0.452	0.297	0.371	0.452	0.297	0.371	0.672**	0.452
In TFP at t + 2	1.462***	1.454***	1.466***	1.462***	1.454***	1.466***	2.115***	1.462***
In TFP at t + 3	1.852***	1.833***	1.895***	1.852***	1.833***	1.895***	2.545***	1.852***
In TFP at t + 4	1.984***	2.038***	2.096***	1.984***	2.038***	2.096***	2.537***	1.984***
In TFP at t + 5	1.694***	1.920***	1.867***	1.694***	1.920***	1.867***	2.218***	1.694***
In labor productivity at t + 1	0.377	0.583	0.684	0.377	0.583	0.684	1.357**	0.377
In labor productivity at t + 2	0.504**	0.464**	0.501**	0.504**	0.464**	0.501**	0.93***	0.504**

In labor productivity at t + 3	0.520*	0.593**	0.664**	0.520*	0.593**	0.664**	1.176***	0.520*
In labor productivity at t + 4	0.806**	0.851**	0.856**	0.806**	0.851**	0.856**	1.296***	0.806**
In labor productivity at t + 5	0.662*	0.825**	0.820**	0.662*	0.825**	0.820**	1.230***	0.662*
<i>Debt growth</i>								
In debt ratio at t + 1	0.399	0.513	0.618**	0.399	0.513	0.618**	1.124***	0.399
In debt ratio at t + 2	-0.061*	-0.052	-0.058*	-0.061*	-0.052	-0.058*	-0.136***	-0.061*
In debt ratio at t + 3	0.015	0.038	-0.006	0.015	0.038	-0.006	-0.084**	0.015
In debt ratio at t + 4	0.041	0.074	0.058	0.041	0.074	0.058	-0.063*	0.041
In debt ratio at t + 5	0.141*	0.126*	0.093	0.141*	0.126*	0.093	-0.005	0.141*
In Z-score at t + 1	0.134	0.154	0.124	0.134	0.154	0.124	0.041	0.134
In Z-score at t + 2	0.043	0.047	0.026	0.043	0.047	0.026	0.119	0.043
In Z-score at t + 3	-0.055	-0.017	-0.019	-0.055	-0.017	-0.019	0.036	-0.055
In Z-score at t + 4	0.037	0.154	0.125	0.037	0.154	0.125	0.058	0.037
In Z-score at t + 5	-0.143	-0.108	-0.067	-0.143	-0.108	-0.067	-0.045	-0.143

Notes: \*  $p < 0.1$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$ , one-sided  $p$ -values. Standard errors are based on Abadie & Imbens (2008), but are omitted to conserve space. They are available on request. Column 1 presents our baseline results. Columns 2 to 4 use nearest neighbor matching with 2, 3, and 4 control firms for each treated firm. Columns 5 to 7 perform nearest neighbor matching using 2, 3, and 4 control firms for each treated firm within a caliper defined as 10% of the standard deviation of the estimated propensity score. Column 8 performs radius matching within the same caliper. Source: Authors' calculations.

Table A8 Results of Rosenbaum Bounds Test for the Baseline Model

Gamma <sup>a</sup> / Time	t + 1		t + 2		t + 3		t + 4		t + 5	
	Sig+	Sig-	Sig+	Sig-	Sig+	Sig-	Sig+	Sig-	Sig+	Sig-
Firm survival										
<b>1.00</b>	0.013	0.013	0.004	0.004	0.029	0.029	0.017	0.017	0.091	0.091
<b>1.05</b>	0.015	0.011	0.005	0.003	0.034	0.024	0.020	0.014	0.124	0.064
<b>1.10</b>	0.017	0.010	0.006	0.003	0.040	0.020	0.023	0.012	0.163	0.045
<b>1.20</b>	0.021	0.007	0.008	0.002	0.053	0.014	0.031	0.008	0.255	0.021
Total assets										
<b>1.00</b>	0.000	0.000	0.005	0.005	0.011	0.011	0.048	0.048	0.244	0.244
<b>1.05</b>	0.001	0.000	0.009	0.002	0.018	0.006	0.067	0.033	0.294	0.199
<b>1.10</b>	0.001	0.000	0.015	0.001	0.028	0.004	0.092	0.022	0.345	0.161
<b>1.20</b>	0.005	0.000	0.038	0.000	0.060	0.001	0.153	0.010	0.449	0.103
Turnover										
<b>1.00</b>	0.301	0.301	0.005	0.005	0.000	0.000	0.000	0.000	0.000	0.000
<b>1.05</b>	0.340	0.264	0.009	0.003	0.000	0.000	0.000	0.000	0.001	0.000
<b>1.10</b>	0.379	0.232	0.016	0.001	0.001	0.000	0.001	0.000	0.001	0.000
<b>1.20</b>	0.454	0.176	0.041	0.000	0.003	0.000	0.002	0.000	0.003	0.000
Value added										
<b>1.00</b>	0.025	0.025	0.083	0.083	0.000	0.000	0.005	0.005	0.002	0.002
<b>1.05</b>	0.035	0.017	0.101	0.068	0.000	0.000	0.008	0.002	0.004	0.001
<b>1.10</b>	0.048	0.012	0.120	0.055	0.001	0.000	0.014	0.001	0.007	0.001
<b>1.20</b>	0.081	0.006	0.163	0.036	0.003	0.000	0.035	0.000	0.017	0.000
Profit										
<b>1.00</b>	0.000	0.000	0.036	0.036	0.008	0.008	0.003	0.003	0.022	0.022
<b>1.05</b>	0.001	0.000	0.049	0.026	0.011	0.006	0.005	0.002	0.034	0.014
<b>1.10</b>	0.001	0.000	0.064	0.019	0.014	0.005	0.009	0.001	0.050	0.008
<b>1.20</b>	0.003	0.000	0.101	0.010	0.021	0.003	0.021	0.000	0.095	0.003
Employees										
<b>1.00</b>	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.009	0.009
<b>1.05</b>	0.001	0.000	0.002	0.000	0.001	0.000	0.002	0.001	0.014	0.006
<b>1.10</b>	0.002	0.000	0.003	0.000	0.002	0.000	0.003	0.000	0.020	0.004
<b>1.20</b>	0.006	0.000	0.009	0.000	0.006	0.000	0.007	0.000	0.036	0.002

Average wage														
<b>1.00</b>	0.114	0.114	0.114	0.664	0.664	0.664	0.224	0.224	0.224	0.330	0.330	0.330	0.560	0.560
<b>1.05</b>	0.136	0.094	0.094	0.580	0.740	0.740	0.294	0.294	0.163	0.263	0.402	0.402	0.494	0.625
<b>1.10</b>	0.160	0.078	0.078	0.497	0.803	0.803	0.370	0.370	0.117	0.207	0.475	0.475	0.430	0.683
<b>1.20</b>	0.211	0.053	0.053	0.345	0.894	0.894	0.524	0.524	0.056	0.122	0.610	0.610	0.318	0.781
Capital														
<b>1.00</b>	0.000	0.000	0.000	0.000	0.000	0.000	0.006	0.006	0.006	0.038	0.038	0.038	0.229	0.229
<b>1.05</b>	0.000	0.000	0.000	0.000	0.000	0.000	0.011	0.011	0.003	0.054	0.025	0.025	0.278	0.186
<b>1.10</b>	0.000	0.000	0.000	0.001	0.000	0.000	0.017	0.017	0.002	0.074	0.017	0.017	0.328	0.150
<b>1.20</b>	0.000	0.000	0.000	0.003	0.000	0.000	0.038	0.038	0.001	0.128	0.007	0.007	0.430	0.095
Bank loans														
<b>1.00</b>	0.576	0.576	0.576	0.066	0.066	0.066	0.442	0.442	0.442	0.403	0.403	0.403	0.399	0.399
<b>1.05</b>	0.618	0.533	0.533	0.041	0.100	0.100	0.355	0.355	0.532	0.328	0.482	0.482	0.334	0.467
<b>1.10</b>	0.657	0.491	0.491	0.025	0.143	0.143	0.279	0.279	0.616	0.262	0.558	0.558	0.276	0.533
<b>1.20</b>	0.725	0.415	0.415	0.009	0.252	0.252	0.161	0.161	0.758	0.160	0.692	0.692	0.182	0.653
Intermediate inputs														
<b>1.00</b>	0.001	0.001	0.001	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.022	0.022
<b>1.05</b>	0.001	0.000	0.000	0.000	0.000	0.000	0.001	0.001	0.000	0.001	0.000	0.000	0.031	0.015
<b>1.10</b>	0.003	0.000	0.000	0.000	0.000	0.000	0.002	0.002	0.000	0.002	0.000	0.000	0.043	0.010
<b>1.20</b>	0.009	0.000	0.000	0.001	0.000	0.000	0.007	0.007	0.000	0.005	0.000	0.000	0.072	0.005
TFP														
<b>1.00</b>	0.000	0.000	0.000	0.005	0.005	0.005	0.000	0.000	0.000	0.001	0.001	0.001	0.056	0.056
<b>1.05</b>	0.000	0.000	0.000	0.010	0.003	0.003	0.001	0.001	0.000	0.002	0.001	0.001	0.075	0.040
<b>1.10</b>	0.001	0.000	0.000	0.017	0.001	0.001	0.002	0.002	0.000	0.004	0.000	0.000	0.097	0.029
<b>1.20</b>	0.002	0.000	0.000	0.042	0.000	0.000	0.005	0.005	0.000	0.009	0.000	0.000	0.151	0.015
Labor productivity														
<b>1.00</b>	0.020	0.020	0.020	0.005	0.005	0.005	0.185	0.185	0.185	0.058	0.058	0.058	0.037	0.037
<b>1.05</b>	0.026	0.016	0.016	0.009	0.003	0.003	0.247	0.247	0.134	0.083	0.039	0.039	0.052	0.026
<b>1.10</b>	0.033	0.012	0.012	0.015	0.001	0.001	0.315	0.315	0.095	0.114	0.026	0.026	0.071	0.018
<b>1.20</b>	0.050	0.007	0.007	0.036	0.000	0.000	0.459	0.459	0.045	0.193	0.011	0.011	0.118	0.008
Debt ratio														
<b>1.00</b>	0.000	0.000	0.000	0.006	0.006	0.006	0.220	0.220	0.220	0.644	0.644	0.644	0.163	0.163
<b>1.05</b>	0.000	0.000	0.000	0.003	0.003	0.003	0.166	0.166	0.284	0.706	0.577	0.577	0.202	0.128
<b>1.10</b>	0.000	0.000	0.000	0.002	0.002	0.002	0.122	0.122	0.351	0.761	0.512	0.512	0.245	0.100

	1.20	0.000	0.000	0.000	0.049	0.064	0.489	0.846	0.390	0.337	0.060	
					Z-score							
<b>1.00</b>	0.505	0.505	0.377	0.377	0.212	0.212	0.212	0.126	0.126	0.656	0.656	
<b>1.05</b>	0.548	0.462	0.308	0.450	0.161	0.161	0.272	0.095	0.165	0.708	0.601	
<b>1.10</b>	0.589	0.421	0.248	0.522	0.121	0.121	0.335	0.070	0.207	0.754	0.547	
<b>1.20</b>	0.663	0.347	0.154	0.652	0.065	0.065	0.465	0.038	0.302	0.829	0.444	

Note: <sup>a</sup> Gamma is odds of differential assignment to treatment due to unobserved factors.  
Source: Authors' calculations.

Table A9 Heterogeneous ATET Estimations According to Firm Size and Trade Orientation

	Firm size						Firm trade orientation					
	Micro firms $N_T = 56$	Small firms $N_T = 36$	Medium firms $N_T = 17$	Large firms $N_T = 5$	Domestic only $N_T = 57$	Importer only $N_T = 14$	Exporter only $N_T = 10$	Exporter and importer $N_T = 33$				
<i>Firm survival</i>												
$\ln t + 1$	0.089***	0.056*	0	0	0.053**	0	0.100	0.03				
$\ln t + 2$	0.071	0.056	0	0	0.070	0	0.100	0.061				
$\ln t + 3$	0.107	0.056	-0.059	-0.2	0.105	0	0.100	0.03				
$\ln t + 4$	0.089	0.083	-0.059	-0.2	0.070	0	0.100	0.03				
$\ln t + 5$	0.018	0.056	0	0	0	-0.071	0.100	0.03				
<i>Output growth</i>												
In total assets at $t + 1$	0.510**	0.028	0.120**	0.075	0.397**	0.251**	-0.073	0.180**				
In total assets at $t + 2$	0.362***	0.050	0.115	0.014	0.201*	0.571**	-0.071	0.173*				
In total assets at $t + 3$	0.384**	-0.048	0.128	-0.089	0.220	0.771*	0.042	0.138				
In total assets at $t + 4$	0.427*	-0.023	0.148	-0.063	0.135	0.701**	0.119	0.037				
In total assets at $t + 5$	1.269*	-0.053	0.289	0	0.287	0.466**	0.213	0.094				
In sales at $t + 1$	2.816***	0.049	0.218**	0.202**	2.125***	2.212**	0.640	0.460***				
In sales at $t + 2$	3.025***	0.176	0.489*	0.302**	2.202**	2.237**	2.766*	0.633***				
In sales at $t + 3$	3.946***	0.199	0.763**	0.242*	2.807**	2.752**	1.932*	0.377***				
In sales at $t + 4$	2.891**	0.473*	0.776	0.281*	2.215*	0.887***	4.224*	0.532**				
In sales at $t + 5$	4.141*	0.547	0.415	0	0.317	1.767***	5.663	0.785*				
In value added at $t + 1$	1.036**	0.225	0.420*	0.357*	0.856	0.861**	0.697	0.701***				
In value added at $t + 2$	1.117	0.345	0.548	0.639***	0.382	1.762**	1.214**	0.771***				

In value added at $t + 3$	1.789*	0.352	0.552*	0.262	0.855	1.718*	1.204	0.871***
In value added at $t + 4$	1.534	1.096**	0.419	0.321*	0.101	2.175*	1.352	0.797**
In value added at $t + 5$	2.183**	0.973*	1.091	0	-0.264	3.067**	0.515	1.474***
In profit at $t + 1$	1.26***	-0.095	0.519	0.176	1.066***	0.213	1.293**	0.994**
In profit at $t + 2$	1.062**	-0.675*	0.290	-0.388	0.347	0.211	-0.005	0.223
In profit at $t + 3$	1.637*	-0.393	-0.837	-0.581	1.048	-0.243	-0.313	0.719*
In profit at $t + 4$	0.322	-0.568	-0.950	-1.162	0.313	1.070	-2.011	0.255
In profit at $t + 5$	0.909	0.211	-1.337	0	-0.965	1.765*	-1.421	1.711**
<i>Labor inputs growth</i>								
In employees at $t + 1$	0.398***	0.163*	0	0.229*	0.411***	0.264***	-0.106	0.326***
In employees at $t + 2$	0.408**	0.220	0.306	0.183	0.346**	0.412***	-0.061	0.391***
In employees at $t + 3$	0.404**	0.383*	0.384	0.276	0.456**	0.640***	0.109	0.317***
In employees at $t + 4$	0.278	0.493**	0.598	0.394	0.117	0.650***	0.069	0.696***
In employees at $t + 5$	0.710	0.357	0.085	0	-0.332	0.886**	-0.052	0.689
In average wage at $t + 1$	0.015	-0.112*	0.056	-0.054**	-0.132	-0.035	0.116	0.069
In average wage at $t + 2$	-0.510**	-0.046	0.046	0.032	-0.508**	0.151*	0.742**	0.232**
In average wage at $t + 3$	-0.584**	-0.025	0.088	0.097**	-0.626***	0.244**	0.741	0.313**
In average wage at $t + 4$	-0.414	-0.199*	-0.052	0.048	-0.611**	0.147	0.949*	0.035
In average wage at $t + 5$	-0.285	-0.353	-0.298*	0	-0.781*	0.178	0.550	0.088
<i>Capital inputs growth</i>								
In capital at $t + 1$	1.489***	0.062	0.160*	0.095	1.104***	0.281*	0.004	0.289*
In capital at $t + 2$	1.436***	0.017	0.049	0.114	0.844**	1.413*	0.017	0.257
In capital at $t + 3$	1.267**	-0.081	0.201	0.457*	0.944**	1.631*	0.156	0.058
In capital at $t + 4$	1.451*	-0.229	1.147	0.426*	1.048*	0.730*	0.172	-0.059
In capital at $t + 5$	4.038	-0.224	2.694	0	1.748	0.402*	-0.104	0.148
In bank loans at $t + 1$	-0.296	-0.471	0.471**	-2.305	0.204	-0.374	1.329	0.516
In bank loans at $t + 2$	-0.730	-1.873*	0.592*	-3.051	-0.464	-0.621	2.441	1.437*
In bank loans at $t + 3$	-0.328	-0.958	0.745*	0.264**	0.274	0.727	3.490	0.565
In bank loans at $t + 4$	1.496	-1.021	2.710*	0.207	1.577	1.353	3.463	0.492
In bank loans at $t + 5$	7.031**	-1.686	3.354	0	6.061**	0.508	7.185	4.481**
<i>Intermediate inputs growth</i>								
In intermediate input costs at $t + 1$	1.620***	0.132	0.185**	0.205*	1.414***	0.781***	1.54**	0.516**
In intermediate input costs at $t + 2$	1.150***	0.110	0.408*	0.187	0.957***	1.157**	1.238*	0.573**



In intermediate input costs at $t + 3$	0.937**	0.172	0.683*	0.181	0.984**	1.712***	1.381*	0.307**
In intermediate input costs at $t + 4$	1.222*	0.370*	0.667	0.311*	0.812*	0.547***	2.121*	0.391*
In intermediate input costs at $t + 5$	2.145	0.407	0.152	0	-0.192	1.243**	1.660	0.783*
<b>Productivity growth</b>								
In TFP at $t + 1$	2.504***	0.512	0.397*	0.243	1.772**	3.132***	0.714	0.525**
In TFP at $t + 2$	2.477***	1.638**	0.414	0.559***	1.475*	3.944***	2.619**	1.601**
In TFP at $t + 3$	3.283***	1.429**	-0.249	0.111	1.765*	3.112*	1.392	1.37**
In TFP at $t + 4$	3.133**	1.562	-0.645	0.125	1.162	2.356	3.324	1.252*
In TFP at $t + 5$	1.346***	0.885	0.850	0	-1.870*	6.112***	4.207	0.879*
In labor productivity at $t + 1$	0.734	0.044	0.419**	0.128	0.547	0.668*	0.802	0.349*
In labor productivity at $t + 2$	0.746	0.191	0.241	0.456**	0.077	1.559**	1.524**	0.405*
In labor productivity at $t + 3$	1.393	-0.085	0.175	-0.014	0.404	1.281	1.095	0.519*
In labor productivity at $t + 4$	1.320	0.372	-0.168	-0.073	-0.015	1.626	1.456	0.059
In labor productivity at $t + 5$	1.473***	0.358	1.005*	0	-0.122	2.636**	0.769	0.698**
<b>Debt growth</b>								
In debt ratio at $t + 1$	-0.473**	-0.073	0.093	0.034	-0.350*	-0.049	-0.277**	0.081
In debt ratio at $t + 2$	-0.194***	-0.023	0.115	-0.029	-0.052	0.232	-0.161	0.070
In debt ratio at $t + 3$	-0.042	-0.094	0.097	0.024	0.040	-0.021	-0.358	0.018
In debt ratio at $t + 4$	0.071	-0.1	0.136	0.165	0.243*	0.188	-0.348*	0.105
In debt ratio at $t + 5$	0.080	-0.137	-0.178	0	0.249	-0.259	-0.302	0.104
In Z-score at $t + 1$	0.041	-0.023	0.154*	0.043	-0.133	-0.031	0.961*	0.233*
In Z-score at $t + 2$	0.274	-0.186	0.397	0.272*	-0.515**	0.192	1.027	0.241*
In Z-score at $t + 3$	0.057	0.137	-0.192	0.125	-0.558*	0.540	0.262	0.104
In Z-score at $t + 4$	-0.855**	0.326**	-0.089	0.054	-1.019**	-0.048	0.382*	0.233*
In Z-score at $t + 5$	-0.314	0.585*	0.034	0	-1.148**	1.664	0.866	0.377**

Notes: \*  $p < 0.1$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$ , one-sided  $p$ -values. Standard errors are based on Abadie & Imbens (2008), but are omitted to conserve space. They are available on request. Balancing property after matching is satisfied in each group; for the sake of brevity we do not report the results, but they are available on request.<sup>a</sup> This represents number of treated observations.  
Source: Authors' calculations.

Table A10 Heterogeneous ATET Estimations According to Firm Region and Sector

	Firm region						Firm sector		
	Zagreb	Western Croatia	Eastern Croatia	Central Croatia	Southern Croatia	Agriculture	Food manuf.	Beverage manuf.	
	$N_T = 16$	$N_T = 8$	$N_T = 37$	$N_T = 38$	$N_T = 15$	$N_T = 83$	$N_T = 27$	$N_T = 4$	
<i>Firm survival</i>									
$\ln t + 1$	0	0.125	0.027	0.079**	0	0.048**	0.074*	0	
$\ln t + 2$	0.063	0.250*	0.054	0.053	0	0.048	0.111	0.250	
$\ln t + 3$	0	0.125	0	0.079	0.067	0.036	0.111	0	
$\ln t + 4$	0	0.125	0	0.079	0.133	0.012	0.148	0	
$\ln t + 5$	0	0.125	0	-0.026	0	0	0	0	
<i>Output growth</i>									
In total assets at $t + 1$	0.028	0.246*	0.116*	0.257**	0.164	0.111*	0.251***	-0.241	
In total assets at $t + 2$	-0.030	0.242*	0.122*	0.171	0.265*	0.098	0.304***	-0.387*	
In total assets at $t + 3$	-0.137	0.484**	0.132	0.160	0.282*	0.100	0.338***	-1.185***	
In total assets at $t + 4$	-0.390**	0.553**	0.147	0.216	0.144	0.049	0.288**	-1.187	
In total assets at $t + 5$	-0.254	0.348	0.032	0.499	0.126	0.235	0.305	-1.921	
In sales at $t + 1$	0.725	0.251	0.963**	2.306***	1.290	1.317**	1.018**	-0.905	
In sales at $t + 2$	1.905	0.033	0.861	2.676**	1.766	1.706***	1.367**	-1.275*	
In sales at $t + 3$	1.215	0.266	-0.309	3.424**	4.025***	1.982**	1.823**	-2.869***	
In sales at $t + 4$	-0.774	1.169	0.051	2.906**	2.249*	1.611*	0.873**	-2.336	
In sales at $t + 5$	-0.050	1.569	0.588	2.902*	0.297	1.784*	0.726	-2.968	
In value added at $t + 1$	-0.681	0.111	0.633	1.910***	0.501	0.737*	0.480*	0.163	
In value added at $t + 2$	-0.219	0.232	0.199	2.404**	0.324	0.882*	0.786***	-0.046	
In value added at $t + 3$	-0.488	0.534	-0.531	3.882***	1.986**	1.447**	1.422***	-0.525	
In value added at $t + 4$	-1.040	1.227	-1.221	3.552***	1.390**	1.313*	0.756*	4.352	
In value added at $t + 5$	-0.094	2.020*	0.206	2.677**	0.939**	1.259**	1.047**	0	
In profit at $t + 1$	-0.328	0.054	0.764*	1.138***	0.667	1.009***	0.134	-1.243	
In profit at $t + 2$	-0.777	-0.248	0.449	0.632	-0.546	0.410	-0.233	-1.631**	
In profit at $t + 3$	-0.443	0.213	0.546	0.523	0.488	0.624	0.044	-1.939*	
In profit at $t + 4$	-0.663	-0.107	0.476	-0.239	-1.683**	-0.206	-0.918**	0.107	
In profit at $t + 5$	1.736	0.756	0.112	0.964	-0.080	0.390	0.682	1.459	
<i>Labor inputs growth</i>									
In employees at $t + 1$	0.162	0.099	0.384**	0.231**	0.361***	0.241***	0.367***	0.089	

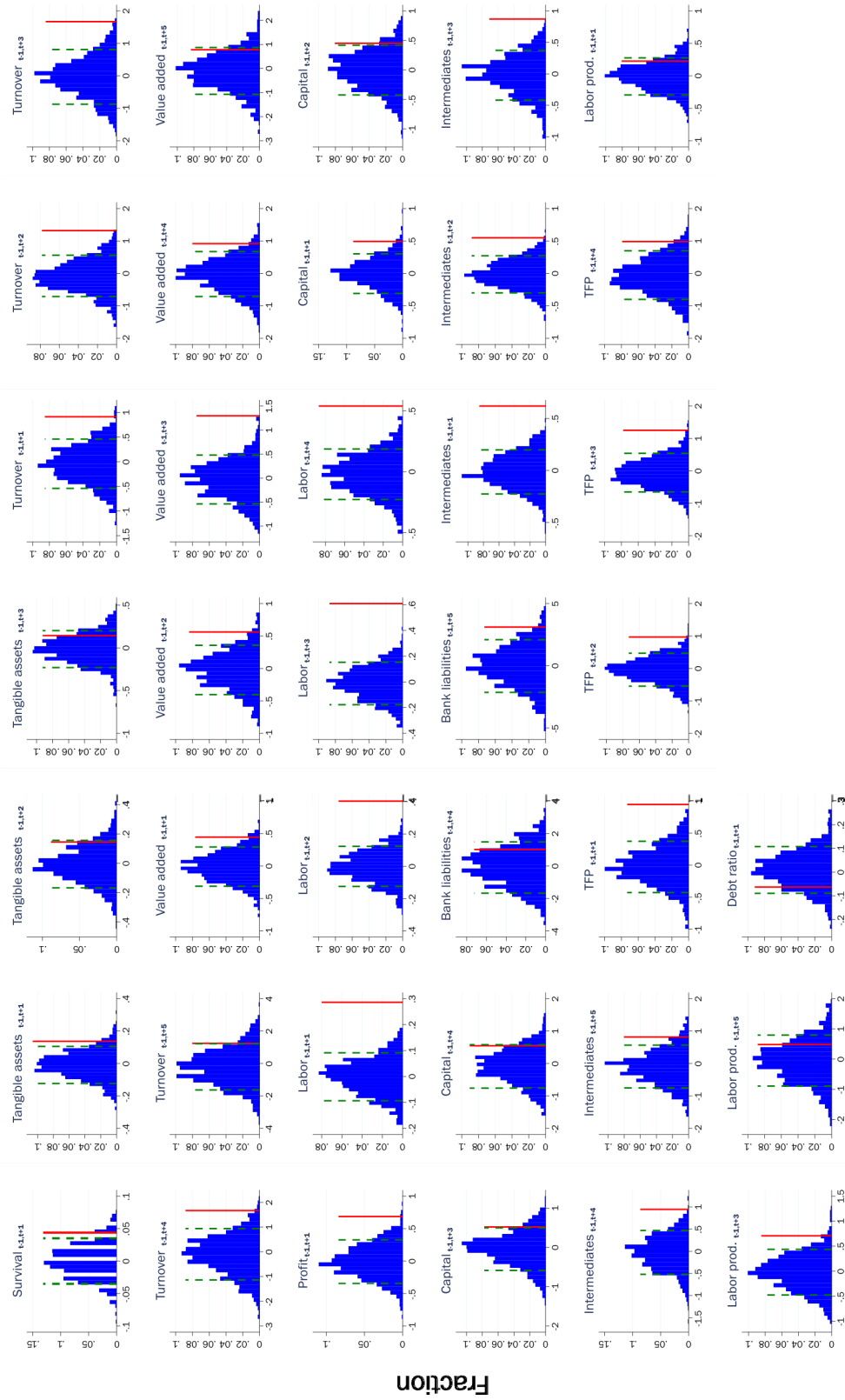
In employees at $t + 2$	0.005	0.128	0.530**	0.48**	0.419*	0.258**	0.773***	-0.512	
In employees at $t + 3$	0.228	0.648	0.425*	0.564**	0.637*	0.278**	1.078***	-1.501	
In employees at $t + 4$	-0.166	1.163	0.358	0.464*	0.481**	0.234	0.723**	0.511	
In employees at $t + 5$	0.513	1.736	-0.852*	1.071**	0.656*	0.228	0.738	-0.087	
In average wage at $t + 1$	0.209	-0.007	-0.064	-0.026	0.188	-0.031	0.047	-0.116	
In average wage at $t + 2$	-0.087	-0.326	-0.001	-0.421*	0.414**	-0.127	0.002	-0.425	
In average wage at $t + 3$	-0.288	-0.150	-0.190*	-0.293	0.449**	-0.261*	0.249*	-0.769	
In average wage at $t + 4$	-0.362	-0.237	-0.091	-0.160	0.166	-0.229	0.152	-0.388	
In average wage at $t + 5$	0.084	-0.018	-0.675	-0.433	-0.127***	-0.439*	-0.009	-1.533	
<i>Capital inputs growth</i>									
In capital at $t + 1$	0.899	0.586***	0.278***	0.670*	0.275	0.594**	0.372**	-0.179	
In capital at $t + 2$	0.229	0.462**	0.199*	0.781	0.526*	0.593**	0.235	-0.428*	
In capital at $t + 3$	0.063	0.743***	0.189	0.921	0.715**	0.751**	0.299*	-1.561***	
In capital at $t + 4$	-0.030	0.630**	0.073	1.196	-0.049	0.705	0.232	-1.108	
In capital at $t + 5$	-0.431*	0.133	0.105	2.245	-0.077	1.048	0.151	-1.964	
In bank loans at $t + 1$	0.502	0.910	0.121	-0.116	-2.059	-0.380	0.498	1.004	
In bank loans at $t + 2$	-0.431**	0.512	0.215	-0.945	-0.568	-1.087**	2.247*	-3.534	
In bank loans at $t + 3$	-2.134*	1.435	1.358	-1.895*	0.491	-0.743	1.314	-7.637	
In bank loans at $t + 4$	-0.788	3.267	1.756	0.608	2.033	-0.046	3.995**	-1.653	
In bank loans at $t + 5$	-1.434**	4.566	4.637*	0.163	3.160	0.892	6.529**	-15.239	
<i>Intermediate inputs growth</i>									
In intermediate input costs at $t + 1$	-0.022	-0.253	0.755**	2.056***	0.643*	1.009***	0.798**	-0.820	
In intermediate input costs at $t + 2$	-0.168	-0.375*	0.917**	1.161***	1.063***	0.707***	0.947**	-1.230**	
In intermediate input costs at $t + 3$	-0.336	0.435	0.393	1.708***	0.843**	0.670**	1.249***	-2.362***	
In intermediate input costs at $t + 4$	-1.315	1.116	0.783*	1.368**	0.656	0.761*	0.787*	-2.121	
In intermediate input costs at $t + 5$	0.204	1.675	-0.411	2.351*	0.230	0.982*	0.713	-1.905	
<i>Productivity growth</i>									
In TFP at $t + 1$	0.737	0.049	1.330**	2.130***	2.588*	1.346***	1.193**	0.278	
In TFP at $t + 2$	1.128	0.153	0.307	3.680***	2.821*	1.640***	2.137**	0.345	
In TFP at $t + 3$	1.289	0.266	-0.107	3.919***	2.528*	1.633**	2.142***	0.535	
In TFP at $t + 4$	-0.97*	0.790	-1.179	4.172***	2.736**	1.212	1.294*	13.243	
In TFP at $t + 5$	-0.182	1.500**	-1.096	0.309	3.946*	0.134	2.237*	-7.301	
In labor productivity at $t + 1$	-0.747	0.012	0.329	1.600***	0.193	0.512	0.110	0.072	

In labor productivity at $t + 2$	-0.170	0.104	-0.299	1.833**	0.253	0.572	0.185	0.464
In labor productivity at $t + 3$	-0.672	-0.113	-0.922*	3.113***	1.296*	1.072*	0.306	0.972
In labor productivity at $t + 4$	-0.874	0.065	-1.699*	2.984***	0.968	0.922	0.047	4.121
In labor productivity at $t + 5$	-0.606	0.285	0.813	1.413*	0.360	0.831**	0.334	0
<b>Debt growth</b>								
In debt ratio at $t + 1$	-0.062	0.368	-0.024	-0.263***	-0.106	-0.128**	0.025	0.439
In debt ratio at $t + 2$	-0.101	0.194	0.113	-0.170***	-0.057	-0.066	0.153	0.121
In debt ratio at $t + 3$	-0.160*	0.126	0.194**	-0.204**	0.284	0.037	0.109	-0.041
In debt ratio at $t + 4$	-0.182	-0.018	0.404***	0.006	0.426*	0.128	0.328**	0.054
In debt ratio at $t + 5$	-0.366	0.168	0.583**	-0.256	0.339	-0.098	0.540*	0.044
In Z-score at $t + 1$	-0.557	0.043	-0.074	0.067	-0.112	0.028	-0.047	-1.182*
In Z-score at $t + 2$	-0.058	0.748	-0.476*	0.272	-0.438**	0.017	-0.140	-0.942*
In Z-score at $t + 3$	0.015	-0.628*	0.297	0.143	-0.327	0.106	-0.002	-0.973*
In Z-score at $t + 4$	0.082	-0.393	0.248	-0.438	-0.252	-0.226	-0.136	0.360
In Z-score at $t + 5$	-0.006	-0.219	-0.384*	0.432*	-0.088	-0.157	0.055	0.722

Notes: \*  $p < 0.1$ ; \*\*  $p < 0.05$ ; \*\*\*  $p < 0.01$ , one-sided  $p$ -values. Standard errors are based on Abadie & Imbens (2008), but are omitted to conserve space. They are available on request. Balancing property after matching is satisfied in each group; for the sake of brevity we do not report the results, but they are available on request. <sup>a</sup> This represents number of treated observations.

Source: Authors' calculations.

Figure A1. Empirical ATET Distribution of Placebo Test with 10,000 Replications



ATTS

## Appendix B: The Derivation of Rosenbaum Bounds

Let us assume that the probability of the treatment  $D$  for observation  $i$  is a function of the observed vector of covariates  $x_i$  and unobserved variable  $u_i$ . More precisely,  $P(D_i = 1 | x_i, u_i) = F(\beta x_i + \gamma u_i)$ , where  $F$  is the logistic function and  $\gamma$  is the effect of the unobserved variable on the probability of treatment. When  $\gamma = 0$  this means that the study is free of hidden bias and the selection into treatment is determined solely by  $x_i$ . When  $\gamma \neq 0$ , two observations, say  $i$  and  $j$ , which have the same covariates  $x_i = x_j$ , can have different probabilities of treatment if  $u_i \neq u_j$ . Since  $F$  is logistic, the odds of treatment for the two observations are  $\frac{P_i}{1-P_i}$  and  $\frac{P_j}{1-P_j}$ , and the odds ratio is given by

$$\frac{P_j(1-P_i)}{P_i(1-P_j)} = \frac{e^{\beta x_i + \gamma u_i}}{e^{\beta x_j + \gamma u_j}} = e^{\gamma(u_i - u_j)}.$$

(i.e., if  $\gamma = 0$ ), or if  $u_i = u_j$ , then  $e^{\gamma(u_i - u_j)} = 1$ . Rosenbaum (2002) showed that the following

$$\text{bounds could be put on the odds ratio: } \frac{1}{\Gamma} = \frac{1}{e^\gamma} \leq \frac{P_j(1-P_i)}{P_i(1-P_j)} \leq e^\gamma = \Gamma.$$

Both observations have the same probability to be in treatment only if  $\Gamma = e^\gamma = 1$ . If for example  $\Gamma = e^\gamma = 2$ , that means that the probability that observation  $i$  receives treatment can be up to twice as high as the probability for observation  $j$ , regardless of the fact that probability should be the same for both units according to the observables, which is the result of hidden bias. This is how Rosenbaum bound  $\Gamma$  measures the extent of the hidden bias.

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